ILLINOIS TREES:

Selection, Planting, and Care

J. CEDRIC CARTER

ILLINOIS NATURAL HISTORY SURVEY

Circular 51

STATE OF ILLINOIS • DEPARTMENT OF REGISTRATION AND EDUCATION
NATURAL HISTORY SURVEY DIVISION • Harlow B. Mills, *Chief*

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FRONT COVER ILLUSTRATION: White pine grows tall and straight in dense plantings and may not have branches to a height of 60 feet or more. The trees shown here are in an area which originally had a dense stand.

are useful for ornamental purposes but do not give abundant shade.

The size of the trees you want will depend largely on where they are to be used. Trees that grow tall—such as American

Fig. 1.—Trees planted close together will serve as a windbreak or sound barrier. Evergreens are especially suitable and effective for these purposes.

Fig. 2.—The densely branched, smooth-leaved, globe elm is an ornamental tree of unusual appearance.

Fig. 3.—The clump birch is used extensively for accent purposes in landscaping.

elm, hackberry, beetree linden, white oak, sycamore, and tulip tree—are suitable for two-story and larger buildings but they tend to accentuate the low or flat appearance of, or hide, one-story buildings (Fig. 4). For attractive and proper balance with one-story buildings, trees that do not grow over 35 feet tall are recommended (Fig. 5). These smaller trees include redbud, hornbeam, crabapple, hawthorn, mountain ash, and persimmon. Environmental conditions that influence the size of trees to select

Fig. 4.—Small or low, flat buildings are dwarfed or hidden by tall trees like the American elm.

Fig. 5 (Below).—Low-growing trees that do not exceed 35 feet in height add to the attractiveness of one-story buildings.

include size of planting area, underground utilities, septic tank distribution fields, and location of walks and other objects.

Another consideration in selection of species is whether you want trees that produce interesting and attractive foliage (Fig. 6), flowers, fruits, or bark. Flowering trees like crabapple, hawthorn, magnolia, and mountain ash are especially attractive in the spring and provide a distinctive setting for a home. Trees with fruits that attract birds include birch, crabapple, dogwood, hackberry, hawthorn (Fig. 7), mountain ash, mulberry, sassafras (female), and tupelo.

Trees selected for their attractive foliage color in autumn include those with purple, red, orange, and yellow leaves. Purple foliage develops on white ash and white oak. Red foliage appears on dogwood, hawthorn, tupelo, and several species of oak. Orange foliage appears on sassafras and sugar maple. Although yellow foliage develops on many species of trees, it is more conspicuous on ash, beech, birch, elm, ginkgo, hickory, linden, mountain ash, oak, poplar, redbud, tulip tree, and yellowwood. The leaves of sweet gum may show all four colors—yellow, orange, red, and purple.

Trees with unusual bark color or formation are especially attractive during the winter. The bark may be green, gray, white, yellow, reddish-brown or mottled. Trees with attractive bark include amur cork tree, beech, birch (Fig. 8), hackberry, Kentucky coffee tree, magnolia, red maple, sycamore, white oak, white poplar, and yellowwood.

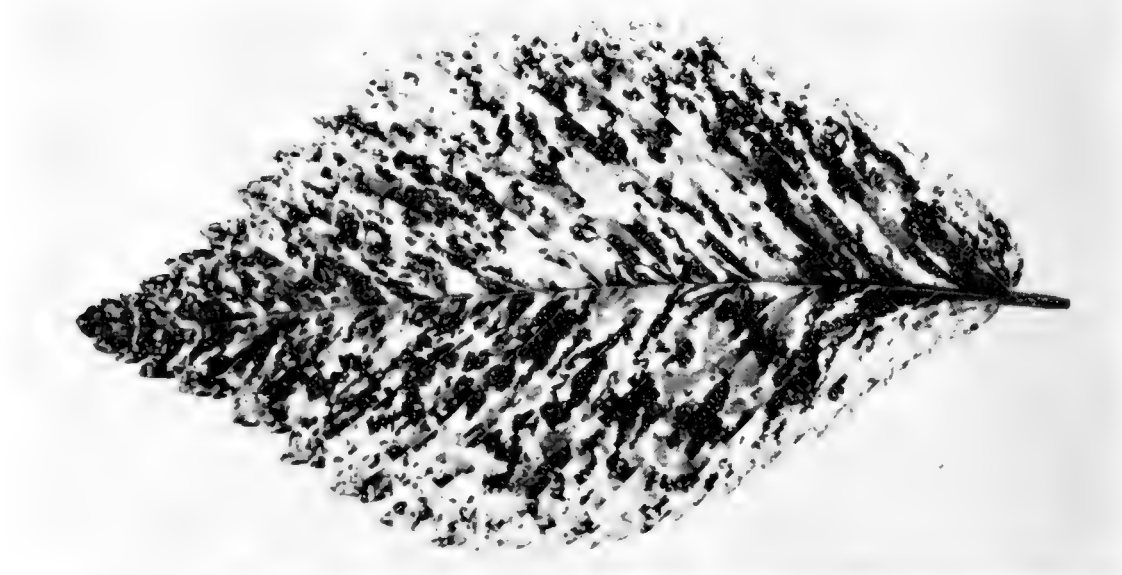

Fig. 6.—Leaf of variegated English elm, showing abundant development of irregular white and light green areas interspersed with normal green.

Fig. 7.—The red fruit of cockspur thorn is attractive in autumn and provides food for birds.

Fig. 8.—The white bark of birch adds to the beauty of the landscape.

Some kinds of trees have disadvantages that make them somewhat undesirable for widespread use, including susceptibility to attack by diseases and insect pests, soft or brittle wood that is easily damaged by wind and ice, fruits and seeds that are large, messy, smelly, or otherwise obnoxious, and abundant shedding of twigs and small branches. Some examples of these conditions are killing of Lombardy (Fig. 9) and Simon poplar by Cytospora canker or by borers, breaking of Siberian elm branches by wind and ice, cracking of the trunks of London plane trees because of low temperatures (Fig. 10), and production of ill-smelling fruit by the female ginkgo. The production of fruit by the mulberry, which as previously mentioned attracts birds, can also be an undesirable characteristic. Since this fruit is soft and decomposes rapidly when ripe, it is messy on walks and attracts flies and other insects.

Seek Professional Advice

Before deciding what species to buy it is desirable to get the advice of a person familiar with trees. Nurserymen, arborists, and landscape men are familiar with the various species of trees, the purposes for which they are used, and the environmental conditions under which each thrives. Such individuals can offer valuable advice on selecting the species or kind of tree most suited for a given location and purpose, when and how to plant, and how to prune the newly planted tree. Also they are familiar with the growth rates of trees, relative sizes and shapes at maturity, and the requirements for best growth. These growth requirements include soil type and acidity, water needs, and whether certain trees grow well in open areas or need partial protection from wind and sun.

Nursery Trees and Wild Trees

Trees obtained from commercial nurseries may be grown in the field (nursery grown) or in impervious containers (container grown). Container-grown trees are sometimes kept in the containers for several years, which may cause the roots to become restricted, intertwined, and twisted. Purchasers should avoid this condition; it may be so serious that the trees grow poorly or do not survive when planted.

Nursery-grown trees have many advantages over wild trees taken from woodland or field locations. Nursery-grown trees are top pruned to produce good shape and root pruned to produce

Fig. 9 (Above).—Lombardy poplar trees frequently are killed by a fungus disease, Cytospora canker.

Fig. 10 (Left).—Cracks which extend into the heartwood are conspicuous in the trunks of some London plane trees during the winter months.

compact, fibrous roots close to the trunks. However, in some nurseries root pruning is not a common practice. The trees are dug by experienced help with a minimum of root injury and usually recover rapidly from the shock of transplanting. Arrangements can be made with many nurseries to replace any trees that do not survive. Local nurseries with experienced workers often plant trees for the purchaser at a nominal charge.

Wild trees taken from woodland or field locations may survive transplanting and grow satisfactorily. However, many do not survive because such trees frequently have wide-spreading fibrous roots which are cut off in digging. Without these roots the trees are unable to take in adequate supplies of water and nutrients. Wild trees that survive may require two or more growing seasons to recover from the shock resulting from the loss of roots. Also, trees growing in dense shade may be spindly and may require severe pruning to produce desirable shapes. Many of them have tender bark which is easily injured by exposure to direct sunlight.

Many states, including Illinois, have laws which require that wild trees as well as nursery-grown and container-grown trees must be inspected by state authorities and certified to be free of diseases and insect pests. This inspection must be made before the trees are moved.

When to Plant

In general, plant deciduous trees in the fall after leaves drop and before the soil is frozen, or in late winter and early spring after the soil has thawed but before the leaves appear. Evergreens are most commonly planted during these same periods. Deciduous trees and evergreens may be planted during the winter or summer if properly handled by trained personnel.

Trees more likely to survive when planted in the spring are:

Bald cypress	Hickory	Sassafras
Beech	Hop hornbeam	Sourwood
Birch	Hornbeam	Sweet gum
Catalpa	Larch	Tulip tree
Dogwood	Magnolia	Tupelo
Fir	Mountain ash	Walnut
Goldenrain tree	Oak	Willow
Hemlock	Poplar	Yellowwood

Trees commonly planted in either fall or spring are:

Arborvitae	Hackberry	Pawpaw
Ash	Hawthorn	Persimmon
Black locust	Honey locust	Pine
Buckeye	Horse chestnut	Plum
Cherry	Juniper	Redbud
Chestnut	Katsura tree	Russian olive
Coffee tree	Linden	Serviceberry
Cork tree	Maple	Spruce
Crabapple	Mulberry	Sycamore
Elm	Osage orange	Tree of heaven
Ginkgo	Pagoda tree	Zelkova

Other Considerations

Chances of survival.—Species of trees that survive and recover from transplanting shock more readily than others include ash, catalpa, cork tree, crabapple, elm, hackberry, honey locust, linden, maple, pin oak, poplar, sycamore, tree of heaven, and willow. Species that survive and recover from transplanting shock less readily include beech, hickory, hornbeam, sassafras, sweet gum, tupelo, walnut, and white oak. The remaining trees described in this circular fall between the above two groups in relation to survival.

Soil pH requirements.—Tree growth is influenced by the acid or alkaline reaction of the soil. Most trees grow best in soils that are slightly acid, pH 6.0–7.0. However, many trees like ash, catalpa, elm, hackberry, linden, sycamore, walnut, white oak, and yellowwood, which prefer a slightly acid soil, will tolerate alkaline soils with pH reactions as high as 7.5. Some trees, such as Douglas fir, flowering dogwood, ginkgo, pin and red oak, red cedar, sweet gum, tulip tree, and tupelo grow best in acid soils, pH 5.0–6.5, and will not tolerate alkaline soils. A few trees, for example bur and shingle oak, grow best in acid soils, pH 5.5 and below.

You may want to select trees suited to your soil condition, or modify the soil to suit the trees. Excessive acidity can be corrected by adding lime to the soil and alkalinity can be corrected by adding sulfur to the soil. The pH of the soil is determined by soil analysis, which can be obtained through the office of the county farm adviser or the University of Illinois Department of Agronomy.

BUYING YOUR TREE

Among the things to consider when buying one or more trees are the size to buy and the cost per tree.

Size to Buy

The size of tree to buy will vary with the species, the effects desired from the new tree, the availability of the size desired, the number of trees to be purchased, and the amount of money you have to invest in plant material. Trees up to about 8 feet tall are often sold by an established price per foot of height. Larger trees may be sold by the trunk diameter in inches, measured 1 foot above the ground, or according to their overall size, shape, and appearance. Trees up to 8 or 10 feet tall usually require less pruning and recover more rapidly after transplanting than do larger trees. More rapid recovery results in more rapid growth, and a small tree may develop into a taller tree in 8 or 10 years than one that was larger at planting time. Less pruning also means less disfiguration and better balanced and shaped trees in years to come. On large trees that require more severe pruning, it is likely that the pruned branch tips will die and numerous sprouts will appear near the cut ends of the branches. Frequently these sprouts give rise to weak, deformed growth that disfigures the tree.

A common practice is to dig large trees, stockpile them in groups on a well-drained site, and cover the balled roots with wood chips or other suitable mulch. Masses of fibrous roots are produced in the mulch. Trees treated in this manner usually recover and become established more rapidly than trees planted immediately after being dug.

Cost of Trees

The cost of trees varies with the species and size. Slow-growing trees that require more years to reach a given size cost more to produce than do fast-growing trees and therefore are sold at higher prices. Small trees that can be moved with bare roots cost less than the same trees of larger size that must be moved with balls of soil.

MOVING YOUR TREE

Careful attention to recommended practices—including pre-digging preparations, methods of digging, and protection of

roots—is good insurance for your success in getting a tree off to a good start after it is moved.

Tying-in Branches, Marking Orientation

Tying-in the branches of low-branched or bushy plants will help avoid injury and facilitate digging. Heavy twine is usually used for tying-in branches, but burlap strips or ¼-inch rope may also be used. To tie-in the branches, attach the twine or other suitable material to a branch at the base of the tree and then wind it spirally around the plant to the top and tie it in a loop (Fig. 11).

Fig. 11.—To prevent unnecessary injury, branches of trees are tied-in with rope or strips of burlap.

Before digging the tree, mark a branch that faces north (or any other direction) so the tree can be properly reoriented when planted.

Digging the Tree

After the branches are tied-in the tree is ready for digging. Deciduous trees under 2½-3 inches in trunk diameter, measured 1 foot above the ground, are usually moved with bare roots. "Bare root" means that most or all of the soil is removed from the roots when the tree is dug. Thus a tree can be dug with a larger root system than if it is taken with a ball of soil.

The digging operation consists of trenching around the tree and removing the soil from around the roots. Dig the trench far enough from the tree to preserve a large proportion of the fibrous roots. This distance is usually 6 inches for each inch of diameter of the trunk. Thus for a tree with a 3-inch trunk the trench would be 18 inches from the trunk. Make the trench deep enough to extend below the level of the lateral roots; the depth may vary from 12 to 18 inches.

After digging the trench, remove the soil from around the roots. It may be shaken off if the tree is small or it can be loosened and combed out of the fibrous roots with a spading fork. Special care is required to keep root injury to a minimum. This is accomplished by working inward from the trench with the spading fork. Greater root protection is obtained if the tree is moved with "semibare" roots—some soil is left clinging to the fibrous roots. This added protection will help the tree recover more rapidly.

After the lateral roots are free of soil, tip the tree to remove the soil from under the plant. Tip the tree very gradually to avoid straining or breaking the roots and loosening the bark near the base of the trunk. Cut any anchor roots or tap roots that still hold at a depth of 14-18 inches. To lift the tree out of the hole, grasp it at the junction of the roots and trunk. Pack the exposed roots in some moisture-holding material, such as straw, sphagnum, peat moss, sawdust, shingle tow, or wood chips, and wrap in burlap to protect against drying and mechanical injury.

"Balled and burlapped" means that the soil is not removed from the roots when the tree is dug. This is referred to as a B&B tree by the nursery trade. Deciduous trees 2½ or 3 inches and larger in trunk diameter, measured 1 foot above the ground,

and evergreens are usually moved and planted with balls of soil covering their roots. The size of the ball will depend on the size and species of tree and the type of soil in which the tree is growing. Trees that are difficult to move, such as beech, hickory, hornbeam, sassafras, sweet gum, tupelo, walnut, and white oak, need larger balls than trees that are easy to move. Trees growing in loose, well-drained soil, such as a sandy soil, will have more extensive or spreading root systems than trees growing in a hard, poorly drained soil like a tight clay.

In general a ball for deciduous trees is approximately 10 inches in diameter for each inch of trunk diameter 1 foot above ground. Therefore, a tree with a trunk 3 inches in diameter needs a ball 30 inches in diameter. If a ball is too large, the roots will be inadequate to hold the soil together and the ball may break apart when the tree is moved.

The ball of soil for evergreens is determined by the height of the plant rather than by the diameter of the trunk. Evergreens 1½-2 feet high need a ball 12 inches in diameter. For each additional foot in height, up to 10 feet, the ball diameter is increased 2 inches. For each additional foot in height above 10 feet the diameter is increased 1½ inches.

Before digging is started, remove any loose soil above the roots. Then make a circle around the plant approximately 6 inches beyond the anticipated diameter of the finished ball. Cut the roots to a depth of approximately 12 inches by inserting a spade at the marked circle with the back side of the spade toward the tree. Using a sharp spade will result in clean cuts which heal rapidly. Next, dig a trench outside and adjacent to the marked circle and about three-fourths the desired depth of the ball, which is usually 10-16 inches.

Trim the ball to proper size and shape with the spade, keeping the back side of the spade toward the tree. Round off the trimmed ball at the top edge and taper it inward toward the base (Fig. 11). Avoid loosening the soil around roots by cutting small roots with a sharp spade and large roots with hand or lopping shears. Next, undercut the ball of soil at an angle of about 45 degrees to sever any remaining roots and to loosen the ball from the soil beneath.

To prevent drying, cracking, and crumbling of soil, wrap the ball tightly with burlap. Balls up to 15 inches in diameter can be completely covered with burlap. One method is to tip the ball and place a piece of rolled burlap under half of the ball. Then tip the

ball in the opposite direction and pull the burlap under the other half. Pull the burlap up around the ball and tie the diagonal corners at the top. Wrap loose folds of burlap tightly around the ball and pin the burlap in place with sixpenny or eightpenny balling nails.

Balls of soil are heavy and difficult to move. A ball of soil 15 inches in diameter and 15 inches deep may weigh 200 pounds or more, and one 24 inches in diameter and 18 inches deep will weigh over 400 pounds. A tree with a small ball of soil can be lifted out of the hole with two spades inserted under the ball from opposite sides, or by placing a piece of burlap under the ball and lifting while grasping the four corners of the burlap. Balls of soil weighing several hundred pounds must be handled carefully to avoid injury to the roots. They should be prepared and moved by arborists, nurserymen, or other persons familiar with the procedures of digging, burlapping, rope lacing, and moving such large balls.

Transporting the Tree

One or several small trees obtained from a nursery or wild stand are frequently transported by car or truck. Trees ordered from distant nurseries are usually sent by freight and shipped by train or truck. Large trees, especially those with soil balls weighing several hundred pounds, are transported by special types of trailers or automotive equipment. This specialized equipment is used by nurserymen, aborists, and other commercial operators engaged in moving large trees.

Protecting the Roots

The roots should never be allowed to dry from the time the tree is dug until it is planted in the new location. Prolonged exposure to air will cause the roots to dry out and die. Roots can be protected by packing them in moist straw, sphagnum, peat moss, sawdust, shingle tow, or other suitable material and then wrapping with burlap.

If your trees are delivered without balls of soil, plant them immediately or heel them in to prevent drying of the roots. Heeling-in consists of digging a trench wide and deep enough to accommodate the roots without crowding. A place with well-drained, sandy, or sandy-loam soil, and where the trees are protected from the sun and wind, is desirable. It is generally best to have the trench running east and west, and to place the trees

so they lean toward the south or southwest. Throw the soil so that a bank will be formed against which the trees can lean. Remove the packing and spread the roots in the bottom of the trench. Cover the roots with fine, moist soil, tamp firmly, and then add enough additional soil to make sure the roots will not dry out.

If the trees are delivered with balls of soil, and are not planted immediately, the soil and roots must be protected from drying out. Cover the soil ball with canvas, or with one of the mulch materials suggested for protecting bare roots, and keep moist until the trees are planted.

PLANTING YOUR TREE

Location, methods of digging the hole, soil conditions, and several other considerations are in order when planting your tree.

Location

Before planting a tree, give careful consideration to where it will be located. This is important because the tree must thrive in the soil where it is planted and also give the desired shading or ornamental effects. For good tree growth and development, the most important requirement is a site that has fertile soil and adequate drainage. There are three general soil types: loam, clay, and sand. Loam soil in general is high in nutrients and has water, air, and temperature conditions suitable for good growth. Clay soil ordinarily is low in nutrients and does not drain well. Sandy soil does not hold adequate water, contains too much air, and is too low in nutrients for good plant growth.

The term "soil" usually refers to the fertile, upper layer, which is also called topsoil. Below this layer is the subsoil, which is frequently composed of clay or hardpan. Subsoil usually is wet, low in fertility, and relatively impervious to root growth. Often when houses and other buildings are constructed the subsoil is mixed with the topsoil. Avoid locating a tree in such a soil mixture, if possible, because it is not suitable for rapid growth.

Good drainage is necessary to allow adequate aeration for root growth and to provide the conditions required by beneficial soil organisms. Bacteria and other microorganisms which decompose the organic matter and aid in releasing plant nutrients cannot function properly in wet soil devoid of air. Roots of trees planted in poorly drained soil such as a clay fill may be sub-

merged in water for long periods of time and suffocate because of lack of air. A tree that was killed because of inadequate drainage is illustrated in Fig. 12. On the other hand, trees planted in sandy soil must be supplied with adequate water or the roots will die from lack of moisture.

Trees should be planted far enough from buildings and other obstacles to allow for adequate sunshine, rain, air circulation, and room for normal growth and spread of branches. Trees planted too close to buildings grow lopsided and crowd the buildings (Fig. 13), frequently resulting in damage to both trees and buildings.

Fig. 12.—Death of the red oak shown in this picture followed root suffocation caused by lack of soil drainage. The leaves turned brown and died before they were fully developed.

Fig. 13.—Trees too close to buildings grow lopsided and their roots may damage the building foundation.

Planting Procedures

Digging the hole.—Dig the hole for a bare-root tree large enough so the roots can be fully expanded and arranged in their normal position (Fig. 14). They should not be twisted, crowded, or arranged in a circle against the wall of the hole or all in one direction. Fig. 15 shows the result of improper root arrangement, where the roots were twisted and pointed in one direction when the tree was planted. Improperly arranged roots may result in retarded growth or even death of entire trees after a few years. Balled trees need a hole 2–3 feet wider than the soil ball (Fig. 16). This allows for a trench 1–1½ feet wide around the ball to be filled with good soil. The hole should be deep enough so the tree can be planted at the same depth as it was before it was dug. Some arborists prefer to set a tree slightly higher than it was in its original position. This allows for settling of the tree.

Providing drainage.—Adequate drainage is essential for the survival of newly planted trees, and any hole in soil that will not drain readily should have drainage provided. If clay or hardpan at the bottom of a hole is underlaid by gravel, you can pro-

Fig. 14.—In planting trees with bare roots the hole should be wide enough to allow 1–1½ feet of backfill beyond the tips of the roots. The depth should be sufficient to allow for the drain tile, gravel fill, and 2–3 inches of soil over the gravel before the tree is placed in the hole. The bottom of the hole should slant toward the tile. The black bars on the branches indicate top growth that should be removed on newly planted trees (see pruning section, page 21).

Fig. 15.—This twisted and lopsided root system resulted from improper planting. Such root systems frequently do not supply adequate nutrients and water for normal tree growth.

vide adequate drainage with holes made by a soil auger or through fissures made by compressed air or dynamite. Fill holes made by a soil auger with gravel.

It is advisable to tile-drain holes for large trees. In clay soil, a single 3- or 4-inch standard agricultural tile drain across the bottom of the hole is adequate if the hole is not over 6 feet in diameter (Fig. 14 and 17). For larger holes and for evergreens, which in general require better drainage than deciduous trees, two lines of tile are recommended (Fig. 16). The tile should lead

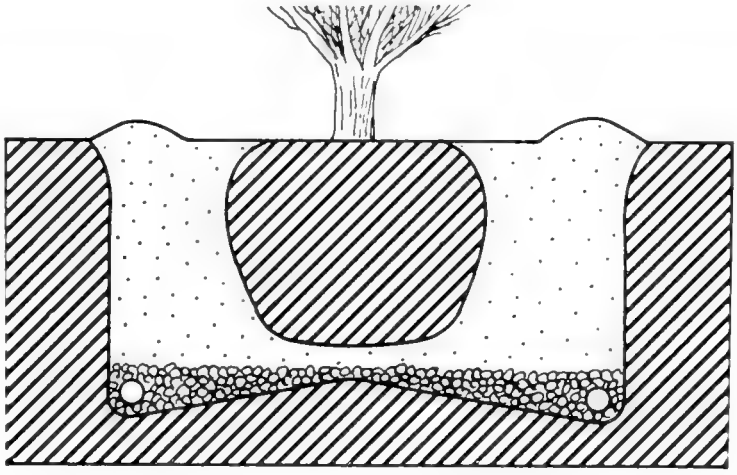

Fig. 16.—Holes for planting trees with balled roots should be 2–3 feet wider than the soil ball and they should meet the other specifications given in Fig. 14.

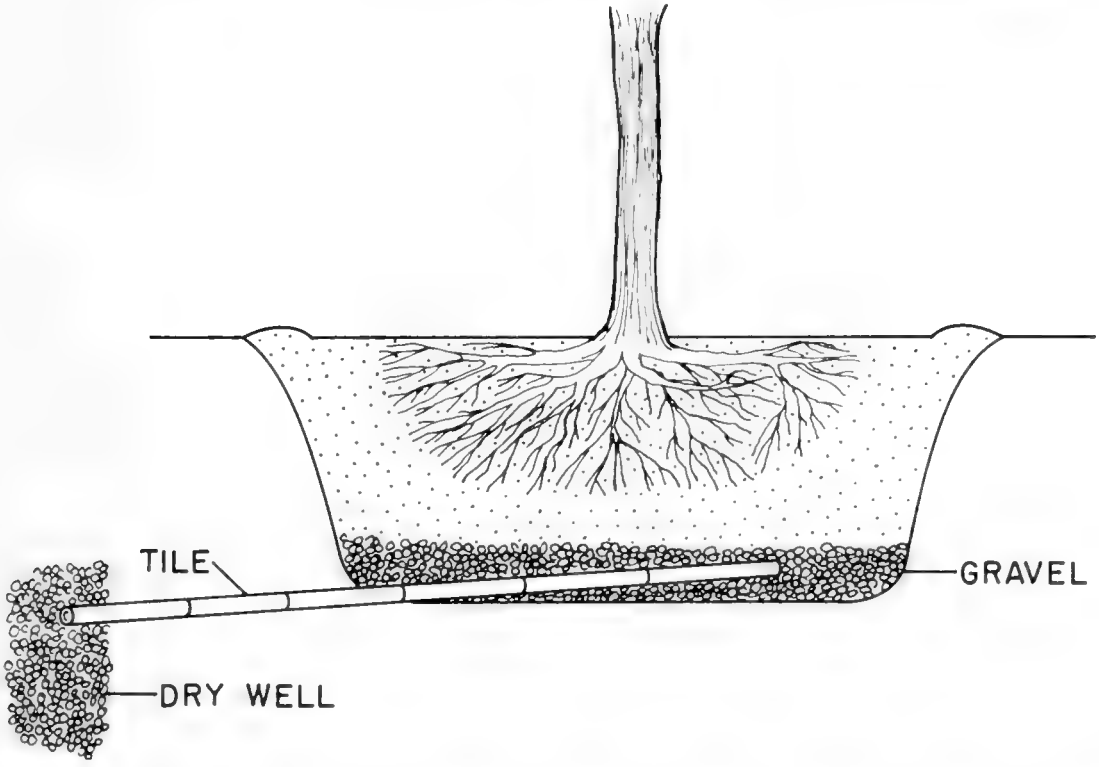

Fig. 17.—Effective drainage of holes not over 6 feet in diameter can be obtained with a single tile drain across the bottom. Place enough gravel in the hole to cover the tile.

to a suitable free outlet or, if such an outlet is not available, a dry well may be installed. A dry well (Fig. 17) is a large hole filled with gravel into which the water can flow. In some locations the drain tiles empty into a storm sewer. Never connect a drain to a sanitary sewer. Do not use crushed limestone in the bottom of the hole; it tends to create an alkaline condition and cause a tree to develop chlorosis.

Improving soil fertility and texture.—Heavy clay soil, low in nutrients, does not allow for adequate aeration and retains too much water for good root growth. Light, sandy soil is low in nutrients, allows for excessive aeration, and does not retain enough moisture for good root growth.

Poor quality soil can be improved in texture by adding peat moss, granulated sphagnum, well-rotted manure, or other suitable materials. Well-rotted manure supplies some nutrients. Usually it is not necessary to add commercial fertilizer until new root growth has developed. However, if the soil is low in nutrients you can improve it by adding superphosphate or commercial fertilizer high in superphosphate such as a 4-12-4 formulation. Five pounds of 20 percent superphosphate is recommended for each cubic yard of soil ($3^{3}/_{4}$ ounces per bushel). The amount of commercial fertilizer to use varies from 3 pounds per cubic yard of soil ($2^{1}/_{4}$ ounces per bushel) for small trees with bare roots to 10 pounds per cubic yard of soil ($7^{1}/_{2}$ ounces per bushel) for large trees with balls of soil.

Breaking the ball.—Delay in planting after a tree is dug may result in the formation of a hard crust an inch or more deep at the surface of the ball of soil, especially if the soil is heavy clay. To assure a better moisture and air supply for good root growth, you can fork off or fracture the hard crust, or punch holes through it, before the backfill is added. A light surface application of a nonionized detergent (not over 1 ounce in 1 gallon of water) may help in initiating water penetration of the ball of soil that has a hard crust.

Placing the plant.—Before placing the tree in the hole, put 2–3 inches of good loam soil in the bottom, or over any drainage material provided, including tile and gravel. To avoid air pockets under the soil ball, arrange the soil at the bottom of the hole so it is slightly higher in the center. If the tree was marked for proper orientation before it was dug, set it so that each side will have the same exposure or position that it had in its previous location.

This is especially important in preventing sunscald or winter injury of bark on smooth- or thin-barked trees. If a tree cannot be properly oriented, you can protect its trunk and large branches by wrapping them with paper or burlap, or coating them with wax or latex.

Filling the hole.—After placing the tree in the proper position, fill the hole with good loam soil. Bare-root trees need special attention. Work the soil in firmly around the roots as the hole is gradually filled. Gently raise and lower the tree slightly as the soil is added, to help eliminate air pockets around the roots. Add the soil in layers of about 6 inches, and tamp each layer to make it firm and to hold the tree perpendicular. Water may be used to settle the soil and to eliminate air pockets around the roots. If the soil is wet it should be tamped very little and the tree may not need "watering in." Spread a top layer of 1–2 inches of loose soil over the tamped soil to serve as a mulch. Leave a ridge or collar of soil at the margin of the hole (Fig. 14, 16, and 17) to form a basin for holding water.

When planting a tree with a ball of soil, remove the burlap before filling the trench around the ball. Heavy burlap left around the ball of soil will reduce the amount of moisture reaching the roots. Also, the burlap may decay slowly and act as a barrier to normal root growth. However, if the soil in the ball is likely to crumble, the burlap can be slit along the sides with a sharp knife, rolled back from the top, and left on the ball.

Pruning.—Newly planted trees should be pruned because many of the fibrous roots through which water is obtained are lost when the trees are dug. In general, removing 15–35 percent of the leaf-bearing wood to compensate for this root loss is recommended to help prevent injury or death of newly planted trees. Remove injured, weak, interfering, and poorly located branches. Entire branches should be removed, leaving the tree with a thinned out crown, one good leader, and an adequate number of well-spaced lateral branches with uncut tips (Fig. 14). Do not remove small twigs along the leader or main branches.

PROTECTING YOUR TREE

After planting your tree, several precautions are necessary to protect it against wind, insect, disease, drought, and other dangers. The following suggestions cover the most commonly required practices—bracing, wrapping, and watering.

Bracing

Most trees over 1 inch in trunk diameter must be braced with stakes or guys to hold them in an upright position and prevent loosening of the soil around the base of the trunk and drying out of the roots. Such bracing is usually required during the first year. One or two stakes are adequate for bracing trees less than 3 inches in trunk diameter. Trees can be braced with 2 x 2 or similar wood stakes (Fig. 18), with light metal posts (Fig. 19), or with guys (Fig. 20). Either two stakes placed on opposite sides of a tree, or one stake or metal post placed on the side of the prevailing winds (1 foot or so away from the tree and driven into the ground 2 or 3 feet), may be used. To avoid injuring the tree roots, set the stakes before the roots are covered with soil.

Attach the tree to a stake with a soft rope or wire run through a piece of hose (Fig. 19 and 20) or other suitable material to avoid injury to the trunk. If the wire encircles the trunk without such protection, it will girdle the trunk and is likely to kill the tree (Fig. 21). Cross or "figure eight" the rope, or twist the wire between the stake and the tree, to prevent chafing of the bark.

Trees more than 3 inches in trunk diameter need three stakes or three or four guys for adequate bracing. To brace with three stakes, place the stakes at equal intervals around the tree and 1 foot from the trunk. Brace the stakes with cleats, attached 4–6 inches below the tops of the stakes, to form a triangular structure connecting the three stakes. Attach the tree to the stakes with soft rope or wire as described above. Trees planted with large balls of soil may not need bracing.

Guys for large trees consist of 3/16- to ¼-inch, 7-strand cable, or two strands of No. 9, or four strands of No. 10 or No. 12 galvanized steel wire, twisted. Attach the guys to the tree through pieces of hose that encircle the trunk at a crotch or through lag hooks equally spaced around the trunk. Place the lag hooks 8–10 inches apart to avoid weakening of the trunk, and in line with the deadmen (anchor pieces) to which they will be attached. Locate the deadmen, which may be 4- by 6-inch pieces of timber 4 feet long buried to a depth of 4 feet, or other suitable anchor materials, at a distance from the tree so that the guys will be at a 45-degree angle when twisted taut. In clay and nonrocky soils, wing anchors 30 inches long or longer can be used in place of deadmen. Examine the guys at regular intervals to see that they are taut and that they are not injuring the trunk.

Fig. 18 (Left).—Wood stakes are suitable for bracing newly planted small trees. A common size of wood stake is 2 x 2 inches and 6–8 feet long.

Fig. 19 (Below left).—Metal posts are strong and durable, and may be used repeatedly for bracing newly planted trees.

Fig. 20 (Below right).—A single guy or wire is sometimes used for bracing small trees. Attach the guy to the tree through a piece of hose that encircles the trunk at a crotch and fasten the other end to a stake placed several feet from the tree.

Wrapping

Protect the trunks of newly planted trees that have smooth bark from sunscald, drying, and borer attacks by wrapping them with special tree-wrapping crepe paper, Kraft wrapping paper of at least 40-pound weight, burlap, or other suitable material. The trunks of trees with coarse or rough bark should be treated with DDT instead of being wrapped. Information on borer control is given in Survey Circular 47, "Illinois Trees and Shrubs: Their Insect Enemies."

Crepe paper reinforced with asphalt is effective in preventing borer injury (Fig. 22). In addition to acting as a barrier, the

Fig. 21 (Above).—Bare guys or wires that encircle the trunk and that are too tight or left on too long will girdle the trunk. Such girdling frequently prevents enlarging of the trunk below the girdle as shown here.

Fig. 22 (Right).—Wrapping the trunks of newly planted trees protects the bark from excessive drying, sunscald, and borer injury.

wrapping reduces loss of water and thus prevents excessive drying of the bark. Dry bark is especially attractive to borers. As a general recommendation, keep the trees wrapped for two growing seasons or until they are growing vigorously. Remove the wrappings each spring and fall to examine the bark for insect injury. If borers are present, treat as recommended in Survey Circular 47, mentioned above.

Rolls of paper or burlap 3–8 inches wide are commonly used for spiral wrappings. Suitable widths are 3–4 inches for small trees, 5–6 inches for medium trees, and 7–8 inches for large trees. Burlap 4 inches wide and sewn on one edge makes a neater wrapping than unsewn or torn strips. Apply the wrapping material neatly. To wrap the trunk, start at the base of the branches and wrap spirally to the ground. Cover any bark exposed below the wrapping with soil. Secure the wrapping with raffia, string, or stout twine (Fig. 22). The twine may be tied around the base of the wrapping with a slip knot and then wrapped, using spaced loops, as shown in Fig. 22, or it may be wrapped spirally around the trunk in the opposite direction to the spiral of the wrapping paper. The twine is tied securely at the top of the wrapping. Examine the twine periodically and loosen it if this becomes necessary to avoid girdling the trunk.

Watering

Newly planted trees with limited root systems need an abundance of water during the growing season. Supply enough water to soak the soil around the roots at each watering, but do not water too often; allow the soil to dry sufficiently between waterings to provide adequate aeration for good root growth. A common practice is to soak the soil thoroughly every 7–10 days during prolonged dry periods in the growing season. Sandy soils require more water to maintain good tree growth than do loam or clay soils. You can get a rough idea of the amount of moisture present by squeezing a handful of the soil. Adequate moisture is available if the soil remains in a firm ball after it has been squeezed.

Water distribution will be more even throughout the root area if dikes, collars, or levees are made around the tree, as indicated in Fig. 17, beyond the edges of the original hole or beneath the tips of the branches, and holes are drilled to various levels in the soil within the dikes. Recently planted trees, and especially evergreens, also need an abundance of water before the

ground freezes in the fall, to carry them through the winter months.

MAINTAINING YOUR TREE

Most trees need careful attention at regular intervals to keep them in good health and growing vigorously. Practices employed in maintaining trees include pruning, fertilizing, watering, spraying, surgery, cavity treatment, bracing, cabling, and protection against grade changes and lightning.

Pruning

Trees are pruned not only to improve their shape and appearance, but to eliminate narrow, weak crotches and poorly located branches, to prevent development of multiple leaders, to

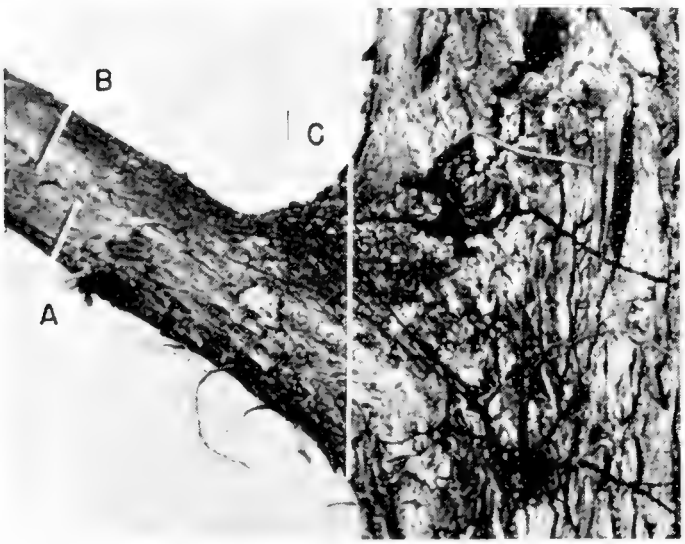

Fig. 23.—To avoid tearing of bark and wood, three cuts are made, as indicated with white lines, in pruning large branches.

Fig. 24.—Topping or cutting all branches to one level is a shock to the tree and usually causes a dense growth of succulent shoots often called water sprouts.

remove branches and stems damaged by wind, ice, and various mechanical agents, and to remove diseased and dead branches.

Ugly wounds caused by splitting of wood and tearing of bark when branches are removed can be avoided through careful practices. Branches that you can hold with one hand (those 2 inches or less in diameter) can be removed with a single cut. Three cuts (Fig. 23) are necessary to remove the larger branches. First, make the undercut, A, 12–18 inches out from the main

Fig. 25.—Excessive pruning by dehorning all major branches frequently results in dying back of the injured branches.

stem. Then make the overcut, B, 2–3 inches farther out. These two cuts will cause the branch to break off by its own weight. Complete the pruning with the final cut, C, removing the stub flush with the main stem. Avoid tearing the bark down at the bottom of the final cut. Coat wounds 1 inch or more in diameter with a wound dressing. Most wound dressings are composed mainly of asphaltum.

Topping (Fig. 24) and dehorning (Fig. 25) are more detrimental than beneficial to trees. Such pruning treatment stimulates abundant sucker or water sprout growth (Fig. 26) which develops into a thick crown of slender, weak branches. The large wounds produced are slow to callus over, and the wood exposed by these wounds is subject to rot.

Fertilizing

To maintain the health and promote vigorous growth of shade and ornamental trees, it often becomes necessary to provide nutrient materials that are lacking or present in insufficient

Fig. 26.—Extensive pruning of large branches or leaders usually results in the production of thick masses or clumps of slender, weak branches. Rot frequently develops in the exposed wood.

Fig. 27.—Lances or needles are useful in supplying water to tree roots.

amounts in the soil. In the forest, where humus accumulates year after year, trees are liberally supplied with organic material derived from decaying leaves and plants. This material supplies nutrients and helps to retain soil water. Since natural sources of nutrients and water often are insufficient along city streets, in lawns, or in parks, fertilizing and watering are frequently necessary. Well-nourished trees appear to be more resistant to drought than those that lack proper nourishment.

Recommendations on fertilizing trees, based on current research, are available from the Natural History Survey on request.

Watering

Although shade trees generally do well in Illinois without watering, lack of water during prolonged dry periods or as a result of temporary or permanent lowering of the soil water table can cause serious injury or result in death of trees. You can supply water to the surface of the soil or through a grid of holes that reach to the root level. Lances or needles (Fig. 27) offer a convenient means for soaking the soil around tree roots. In surface watering, you can use sprinklers or soakers, or allow the water to run slowly from a hose. Soak the soil to a depth of approximately 14 inches. Generous waterings at 2-week intervals give better results than frequent light waterings.

Spraying

Sprays are used to control insects and diseases, to kill brush and other undesirable plants, and to correct nutritional deficiencies. The effectiveness of any spray material depends on obtaining complete coverage of the treated parts with the proper material at the right time.

You can control most insects by applying insecticides after the pests have appeared. To control diseases, however, fungicides should be applied as protectants before infections occur, and not as cures after the diseases have appeared. Since fungicides are applied to the surface of plants, they act as barriers or protectants against germs. Therefore, they are of major importance in the control of foliage diseases. Many pests do not cause serious damage each year and it is not necessary to spray annually for their control. However, trees subject to repeated attacks of a disease, such as leaf spot, blight, or blotch, should be sprayed annually until the disease is brought under control. Spraying annually with an insecticide is necessary to control

the elm bark beetle that carries the Dutch elm disease fungus and the elm leafhopper that carries the phloem necrosis virus.

Minerals may be sprayed on foliage of trees to correct some nutritional deficiencies. Chlorosis resulting from an iron deficiency can be corrected temporarily by spraying the foliage with a solution of ferrous sulfate or other suitable iron compound. This type of treatment is effective only on the foliage sprayed and only for a single growing season. Most lasting control is obtained by treating the soil to correct the deficiency.

Improper spraying, the use of the wrong material, or spraying at the wrong time may result in plant injury. Spray injury may occur as discolored, distorted, or burned leaves, defoliation, killing of twigs and branches, or stunting of growth. Spray drift or vapors from herbicides such as 2,4-D and 2,4,5-T frequently cause injury to trees as well as other plants.

Surgery

Some types of tree injuries and diseases may be corrected or overcome by surgery. Limited bark injuries caused by rodents, humans, machinery, and other objects can be overcome by removing the damaged bark, tracing (cutting) the margins back to the uninjured bark, and then coating the exposed wood with tree wound paint or shading the wounded part. Shading the wound area within a few hours after the damage has occurred, and before the injured tissues are exposed to the sun, prevents drying and death of the living cambial cells that remain on the surface of the exposed wood and encourages the entire surface to callus over rapidly. Extensive injuries with destruction of the cambium and girdling damage by rodents may be overcome by bridge grafting.

Canker diseases that attack trunk bark and wood, such as fire blight and target canker, may be controlled by surgery. In removing the diseased tissues and disinfecting and painting the exposed wood, exercise care to prevent spreading the disease organism to other parts of the tree or to other trees. An effective disinfectant is denatured alcohol.

Cavity Treatment

You can prevent wood decay which produces cavities in trunks and branches by properly treating freshly made wounds as described in the surgery section above.

Wood rot diseases, once established, are very difficult if not

impossible to control since there is no practical way of determining when all of the fugus-infected wood has been removed. Removing the decayed wood and disinfecting the underlying exposed wood does not insure elimination of the fungus, because many of the wood-rotting fungi penetrate the wood from a few inches to several feet beyond the limits of visible decay. To treat cavities resulting from wood rot, remove as much of the rotting wood as possible or practical, and try to avoid injuring the living bark and sound wood. Use brace rods or other feasible means to add to the physical strength of the tree, and disinfect and seal the exposed wood to protect it against fungi and insects. Make the treated area as durable as possible and acceptable in appearance. In some instances there may be a desire to have the cavity filled with some suitable material such as concrete (Fig. 28). Special skills, equipment, and materials are required for the most effective treatment of cavities. Therefore, this work should be entrusted to a professional arborist.

Bracing and Cabling

Bracing (Fig. 28) and cabling (Fig. 29) supply artificial support to structurally weak or injured trees. The timely

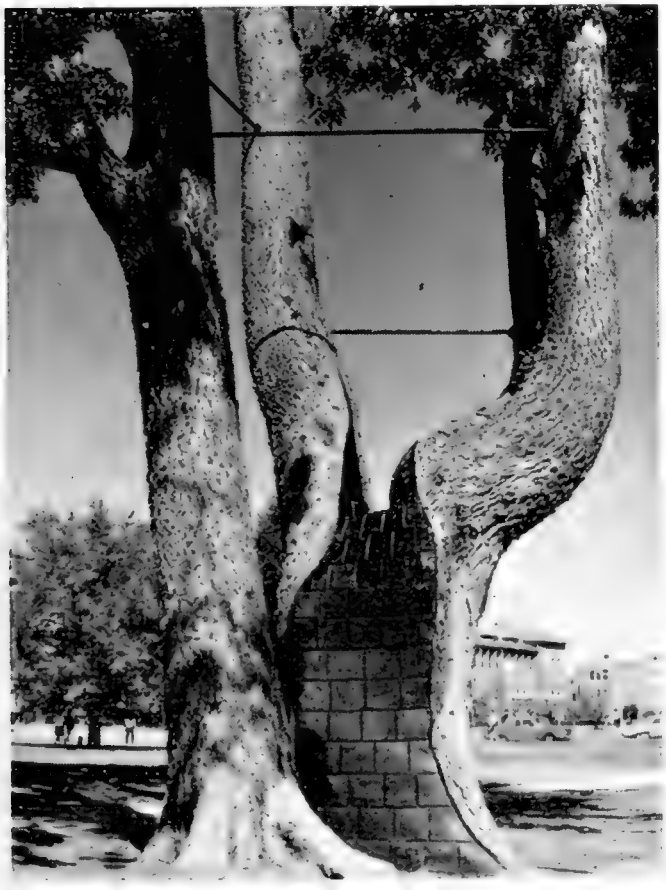

Fig. 28.—Cavities may be filled with concrete or other suitable material. Bracing gives support to the tree and prevents breakage from ice and wind.

and proper installation of brace rods and cables may prolong the life and improve the appearance of a tree. Trees which produce brittle wood, or which have narrow, V-shaped crotches (Fig. 30), such as honey locust, poplar, Siberian elm, soft maple, and willow, are especially susceptible to breakage from wind and ice storms. Such trees frequently need artificial support to overcome their structural weaknesses or to correct for storm injury. Usually bracing and cabling is hazardous work and should be performed by trained individuals who have the proper skill, materials, and equipment.

Grade Changes

Removing or adding soil around trees frequently causes injury to roots. Excavating over 6 inches of soil usually injures or destroys numerous fibrous roots through which trees obtain water and nutrients (Fig. 31). Limiting the supply of water and nutrients retards growth and causes branch dieback, general decline, or death of the affected trees.

Frequently trees can be maintained by building retaining walls (Fig. 32) to avoid lowering the soil where most of the fibrous roots are growing, although the adjacent grade may be lowered considerably. If such corrective measures are not prac-

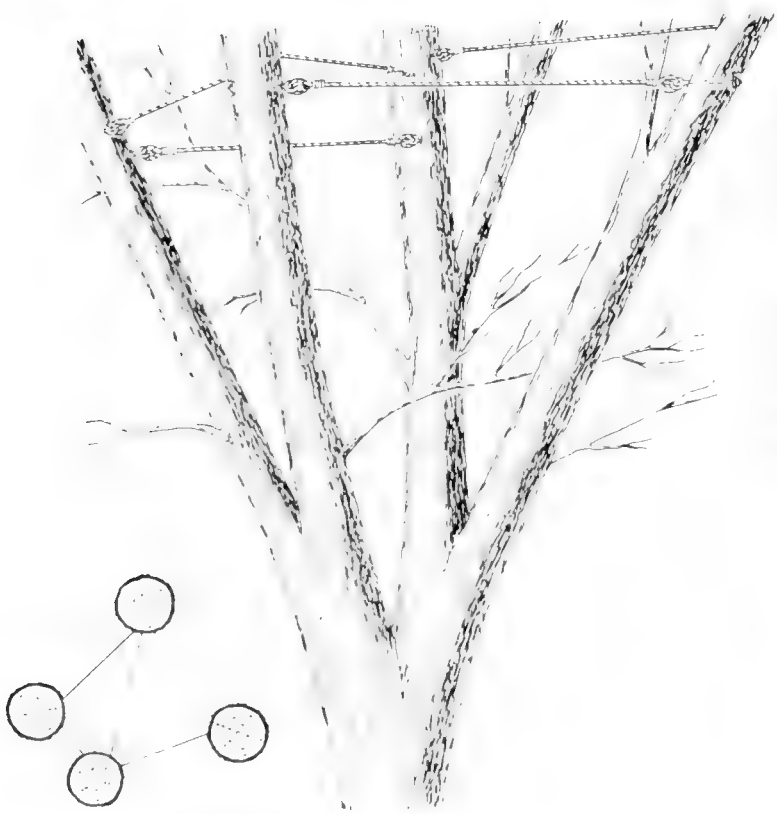

Fig. 29 (Left).—Cabling prevents branches or sections of trees from splitting or breaking. Such protection is especially important during wind and ice storms.

Fig. 30 (Below).—Narrow, V-shaped crotches (left) are weak because the wood tissues are not uniformly united and patches of bark become embedded in the tissues. Crotches with wider angles (right), called U-shaped crotches, are strong.

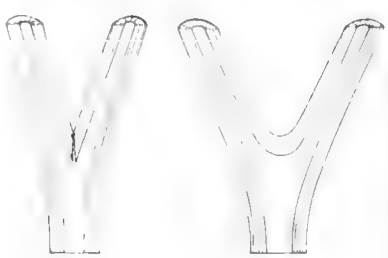

Fig. 31.—Excavation within a few feet of tree trunks destroys roots and may result in the eventual dying of branches or death of injured trees.

Fig. 32.—Retaining walls to maintain soil around trees may prevent root injury where extensive excavation or erosion occurs.

tical, you can help the affected trees recover by supplying additional nutrients and water until their fibrous roots overcome the effect of excavation, and by doing some corrective pruning to reduce the amount of top growth that must be supported by the injured root system. Professional arborists are familiar with the practices required to prevent or overcome such injury, including the subsequent fertilizing and watering needed during the recovery period, which may be 2 years or more.

Raising the grade around trees by adding soil can be as injurious to roots as lowering the grade. Roots buried under an extra foot or more of soil may suffocate and die because of an overabundance of water and inadequate air. Deep soil fills may cause root injury resulting from compaction of soil around the roots. Pavement placed on the fill soil will reduce the amount of air and water available to the roots (Fig. 33). Even covering roots and trunk bases with soil or paving during construction

Fig. 33.—Branch dieback or general decline of honey locust caused by soil fill and paving over the root system.

may be injurious (Fig. 34, 35, 36). Building a frame around a tree (Fig. 36) may protect the trunk during construction, but it will not prevent root injury caused by fill.

To reduce injury caused by fill, adequate air must be supplied to the roots. You can accomplish this by placing gravel or a grid of tile and gravel over the root area of the tree before the fill is made. But before any fill is made, remove all plants and sod from the area to be filled, and break up the soil surface above the roots. Then add fertilizer as needed.

Coarse gravel may be spread over the soil surface beneath the branch spread of the tree to provide adequate root aeration (Fig. 37). In fills of 12 inches or more, start with 3–6 inches of gravel beneath the tips of the branches and gradually increase the depth toward the trunk of the tree until it is 8–12 inches or deeper within 2 feet of the trunk. Extend the gravel upward around the trunk to the level of the new fill and to a radius of 2 feet beyond the trunk. Place a thin layer of straw or hay over the

Fig. 34 (Above left).—Filling soil over the roots of trees during construction may injure or kill roots in the soil beneath and result in the decline or death of affected trees. Roots of the elms in this picture are under 5–10 feet of soil.

Fig. 35 (Above right).—This London plane tree had soil piled to a depth of 4 feet up the trunk for one growing season. The tree produced numerous small roots near the top of the soil fill. However, the bark on the basal portion of the trunk covered by soil was killed and the tree died.

Fig. 36 (Right).—A wooden frame built around a tree trunk may protect the bark on the trunk from injury by construction equipment but it will not prevent root injury from a fill of soil.

gravel to prevent the soil from sealing the air spaces in the gravel, then spread good topsoil over the area to the desired depth. The continuous layer of gravel, which extends to the surface of the fill around the trunk and separates the original soil and the fill soil, will provide adequate aeration for normal root activity and growth of the tree.

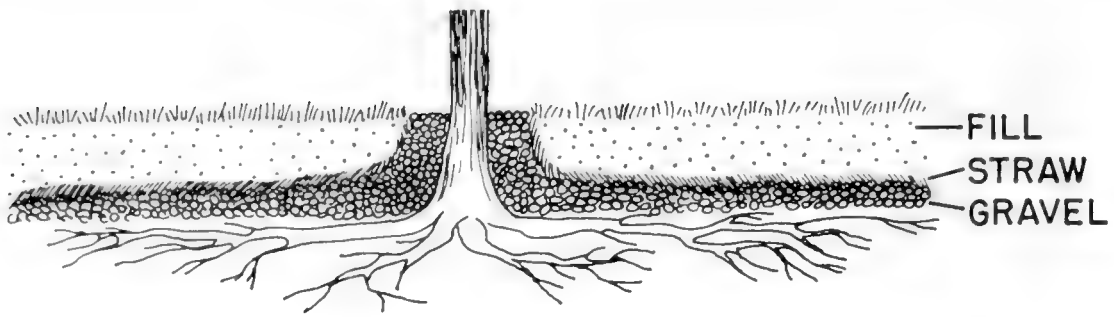

Fig. 37.—Coarse gravel spread over the original soil surface before additional soil is applied as a fill will give adequate aeration to prevent root injury.

Another method of providing adequate aeration and drainage when the grade level is raised is shown in Fig. 38. With this system, air and water can reach the roots through the tile even when fills are quite deep. Also it is easy to fertilize and water a tree as needed through the radiating tile. First arrange five or more lines of 4- to 6-inch porous drainage tile as spokes of a wheel with the trunk as the hub. Next, arrange a circle of tile as the rim of the wheel, or connect the spokes with straight lines of tile. Make the ends of the tile lines near the tree trunk higher than the ends that join the circle or rim of tile. The outer ends of the radial tile lines may stop where they join the circle of tile, or they may be extended beyond the circle, and they should slope downward for good drainage as illustrated in Fig. 38. Place 6-inch bell tiles upright over the junctions of the lines of radial tile and the circle to serve as vents. Extend these upright tiles, held in place by stones, to the planned grade level.

The opening or well around the trunk can be made of stone or brick and must be as high as the level of fill. Build the well large enough to allow for a 1- or 2-foot open area between the trunk and the well wall. Cover all ground tile to a depth of 12–18 inches with rock, then cover the rock with gravel. Place a thin layer of straw or hay over the rock and gravel, then complete the fill with about 12 inches of good topsoil, leaving the well around the trunk, and the bell tiles open. Cover the ends of the lines of tile opening into the well with coarse gravel. A vertical section of the completed fill is shown in Fig. 39.

In some instances it may be desirable to fill the bell tiles with coarse gravel and cover them with a screen. Also, the entire well can be filled with coarse gravel or with a mixture of equal parts of crushed charcoal and sand. However, if the well is to be filled, it is not necesary to build the stone or brick wall.

Lightning Protection

In recent years protection of trees from lightning strokes has received much attention and there has been an increasing demand for protecting trees of historical value or other significance. For such protection it is advisable to obtain the services of arborists or others who are well trained and qualified to make the proper installations.

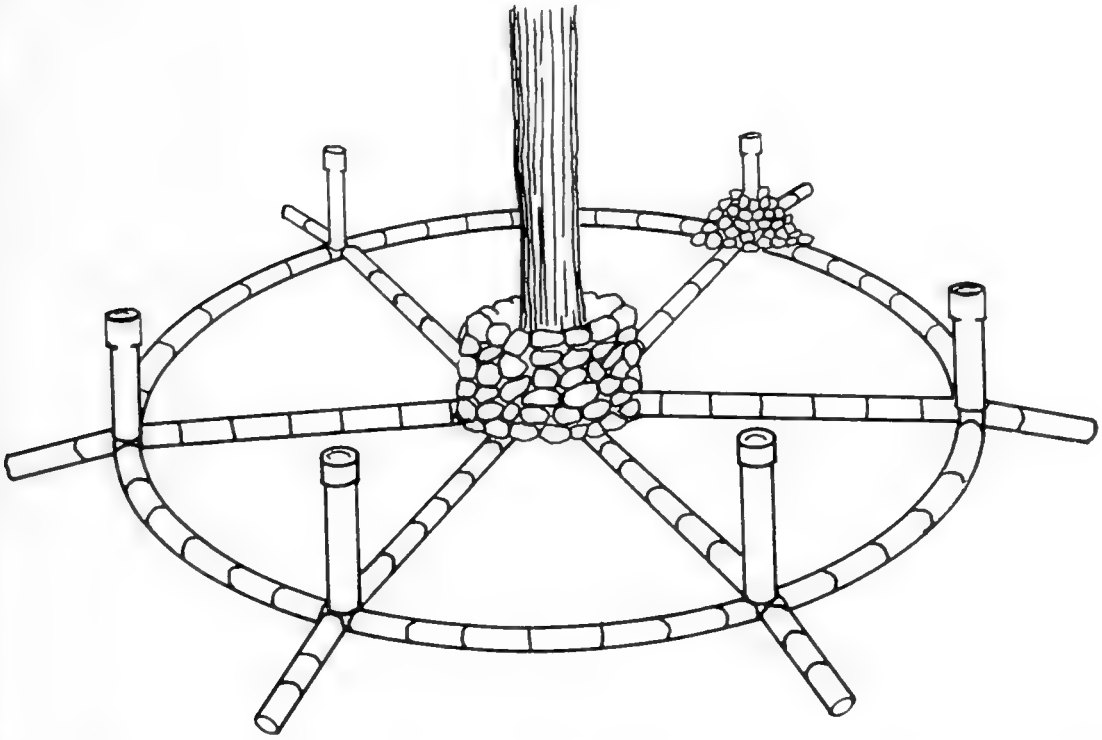

Fig. 38.—Porous drainage tile arranged as a rim and spokes of a wheel, then covered with gravel, will allow for aeration of roots where soil fills are made.

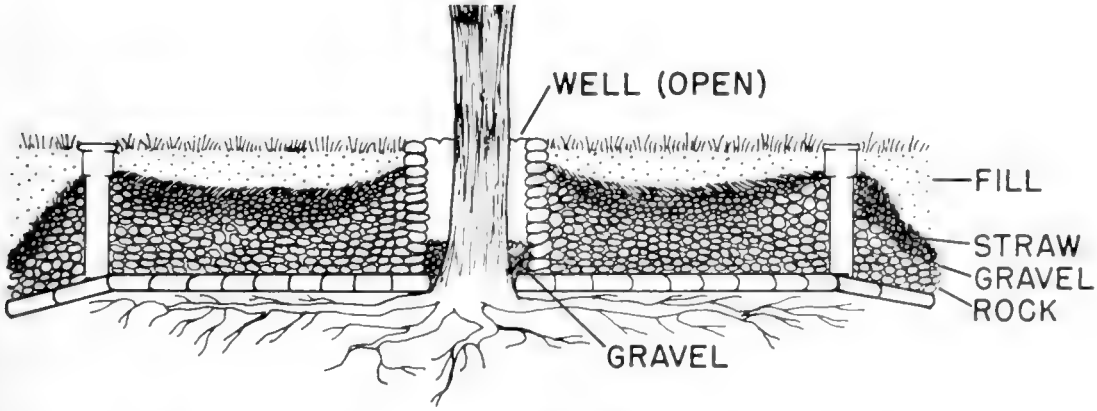

Fig. 39.—Completed fill in vertical section including ventilating tiles, open well around tree trunk, and soil fill over gravel and straw.

TREES CONSIDERED

Arborvitae

In Illinois, arborvitae, or white cedar (*Thuja occidentalis*), (Fig. 40) is native to only a few counties in the northeastern part of the state. However, it is grown throughout the state for ornamental purposes. Also, it is used extensively in hedge plantings for screening and windbreaks. It will thrive in wet, neutral to alkaline soil and in partial shade. During severe winters it is subject to injury, especially in the northern part of the state. In some years, it is severely defoliated by bagworms, and such defoliated trees usually die. Also, it is a host of the spruce spider mite.

Arborvitae is a small tree, reaching a height of 30–60 feet, with a straight or divided trunk. The short branches bend upward to form a narrow, compact, conical head. The leading branches have long-pointed leaves about ¼ inch long while the lateral branches have sharp-pointed, flattened leaves about ⅛ inch long (Fig. 40 inset). Small, solitary, yellowish male and pinkish-green female cones are produced on the tips of short

Fig. 40.—Arborvitae is a small evergreen tree used for screening and ornamental purposes. Inset shows tip of a lateral branch with flattened, ⅛-inch-long leaves on several twigs.

lateral branches. The mature seed-bearing cones, $\frac{1}{3}$–$1\frac{1}{2}$ inch long and oblong, open in autumn of the first year. The mature bark is red tinted and is broken into narrow ridges by shallow fissures. The brown tinted, yellow wood is aromatic. Although it is light in weight, soft, and brittle, its grain is straight and coarse and it is durable. It is used for railroad ties, poles, posts, shingles, and canoes.

Ash

In ornamental plantings, ash (Fig. 41) is used in parks, parkways, and occasionally along streets. It may also be used as a specimen tree. White (*Fraxinus americana*), black (*F. nigra*), red (*F. pennsylvanica*) and blue (*F. quadrangulata*) ash are native to Illinois. The introduced European ash (*F. excelsior*) has ornamental value. Black ash grows best in low, wet areas. Blue ash thrives on dry hills and grows as a tall tree with a narrow crown. It is well adapted for lawn and street plantings. Of these five species, white ash and green ash (*F. pennsylvanica* var. *subintegerrima*), a variety of red ash, are grown throughout the state. These two tall, rapid-growing species are

Fig. 41.—Ash is a rapid-growing tree with broad, spreading branches. The foliage turns yellow to deep purple in autumn. The compound leaves (inset) are composed of 5–11 leaflets.

used extensively in street, lawn, and group plantings. As specimen trees, they usually develop round tops. Blue and green ash grow to a height of 60 feet, while white ash may reach a height of 80 feet.

The 8- to 12-inch-long, thin, compound, opposite leaves (Fig. 41 inset) of these five ash species are composed of 5–11 egg-shaped to elongate leaflets. They measure 3–6 inches long and vary in color from light yellow-green to dark green according to species. The leaves turn yellow to deep purple in autumn. On white and green ash, the inconspicuous male and female flowers are produced on separate trees. The paddle-shaped, winged seeds are produced in clusters. The bark is thick, dark brown, and deeply fissured with rounded, scaly ridges on white ash; red tinted to brown and slightly furrowed and scaly on green ash; and thin, light gray, and broken into large plates on blue ash. The hard, close-grained wood of some ash species, especially white ash, is tough and strong, and it is used for tool handles, oars, and sporting and athletic goods.

Ash is subject to attack by some insects and diseases. It is occasionally attacked by the fall webworm and green ash is especially subject to injury from oystershell scale. Also trees weakened from growing under adverse conditions may be killed by borers. In recent years many ash trees have died from what seems to be a disease of unknown origin. Affected trees show gradual dying back of branches followed by death of the trees in several years.

Bald Cypress

This tree (*Taxodium distichum*) (Fig. 42) grows tall and straight, reaching a height of 150 feet. Although it is a native tree in the swampy river bottoms of extreme southern Illinois, it will grow throughout the state and in many soil types. It grows rapidly and is useful for ornamental purposes. It is resistant to injury by ice and wind.

The leaves (Fig. 42 inset) measure $\frac{1}{4}$–$\frac{3}{4}$ inch long and are produced in a feather-like fashion on two sides of the small branchlets. These branchlets with the leaves still attached drop off in autumn. The long, drooping clusters of male flowers and the globe-shaped, green, scaly, female flowers are borne separately on the same branch, the female flowers at the end of the branch. The fruit is a small, globe-shaped, woody cone which consists of thick, irregular scales, measures about 1 inch in diam-

Fig. 42.—Bald cypress, a rapid-growing tree, produces a tapering trunk that is strongly buttressed at the base. The twin trees in this picture are about 90 feet tall. The needle-like leaves are produced on two sides of small, feather-like branchlets (inset).

eter, and contains heavy, angled seeds. The 1- to 2-inch-thick, cinnamon-red bark is divided into broad, flat ridges by narrow fissures. The straight trunk has long, slender branches which give young trees a narrow, pyramidal shape. However, old trees usually have very broad, low crowns. In swampy sites the roots send up woody growths called "cypress knees" which are conspicuous above the water. Cypress lumber is durable and is used for many purposes.

Beech

American beech (*Fagus grandifolia*) (Fig. 43) is limited in its distribution to 17 counties in the southern and southeastern sections of Illinois and to Lake County in the northeastern corner of the state. It is a native forest tree which grows best in deep, rich soil, and it does not lend itself readily to cultivation. As a specimen tree it has a round head with wide-spreading branches and may reach a height of 80 feet.

The egg-shaped to somewhat oblong, thick, firm, sharp-pointed, alternate leaves (Fig. 43 inset), 2½–5 inches long, are

Fig. 43.—The slow-growing American beech is a large tree with conspicuous light gray, smooth bark and egg-shaped to somewhat oblong, thin, leathery leaves (inset).

sharply and coarsely toothed, dull green above and pale green and shiny beneath. The yellowish-green, drooping, globe-shaped clusters of male flowers, and the female flowers in pairs surrounded by numerous pointed scales, are produced separately on the same tree. Each fruit is a ¾-inch, short-stalked, prickly bur which splits into four parts to liberate two small, shiny, brown, three-sided, sweet, edible nuts. The thin, smooth, light blue-gray bark is often mottled with dark spots. Beech is a slow-growing tree that is difficult to transplant.

The ornamental forms of the introduced European beech (*F. sylvatica*) will grow under more variable environmental conditions. The purple or copper form (Fig. 44) is prized for its foliage color and for its silhouette in winter. The columnar form (Fig. 45) is used for accent purposes. It has no objectionable flowers or seeds, and its foliage is light yellow in autumn.

Beech is relatively free of diseases and insect pests. Occasionally it is injured by application of fertilizer. To prevent such injury, apply only half of the amount of fertilizer commonly recommended for trees.

The hard, close-grained wood of the American beech, with

Fig. 44.—The leaves (inset) of purple or copper beech are purple in the spring and summer and later become copper colored.

Fig. 45.—The columnar form of beech, with its lustrous leaves (inset), is used for accent purposes in landscaping.

Fig. 46.—The weeping form of European birch is prized for its white, papery bark, pendulous branches, and deeply cut leaves (inset).

light to dark red heartwood and nearly white, thin sapwood, is strong and tough. However, it is hard to season, and it is not durable in the ground. It takes a high polish and it is used extensively for furniture, tool handles, veneer, and fuel. The slight, silver grain on the radial surface makes it distinctive when used for flooring and stairways.

Birch

Six species of these trees, European (*Betula pendula*), cherry (*B. lenta*), yellow (*B. lutea*), river (*B. nigra*), canoe (*B. papyrifera*), and gray (*B. populifolia*) birch, are hardy in Illinois. Birch is used for specimen, park, and lawn plantings, and grows well in moist, rich soil.

The smooth and sometimes papery bark of young birch trees is distinctive and is white in some species. The pointed, irregularly toothed, alternate leaves, 1½–6 inches long, vary from egg shaped on cherry, yellow, river, and canoe birch to triangular on European (Fig. 46 inset) and gray birch. They are dark green above and lighter beneath. The leaves of most birch trees turn yellow in autumn. The male and female flowers are produced on separate and conspicuous catkins on the same tree. The brown

male catkins start forming in autumn while the green female catkins do not form until spring. The erect, conelike fruit, ¾–1½ inches long, contains oval nutlets which appear rounded because of lateral wings.

Some birches are relatively small trees, growing to a height of 30–50 feet (European birch), while other birches reach a height of 60–70 feet (cherry birch). Also, the birches with pendulous branches are graceful in appearance (Fig. 46). Birch trees are attractive to birds.

Birches growing on dry sites and in soil low in fertility are frequently attacked by the bronze birch borer. Extensive borer damage results in death of infested trees. Also, such weakened trees are susceptible to Melanconium canker, a fungus disease. In wet seasons the leaves may be affected by such fungus diseases as powdery mildew and leaf spot. The hard, close-grained wood of birch, is strong and is used for agricultural implements, furniture, dowels, toothpicks, and numerous other articles, especially novelties. The wood of cherry and yellow birch is heavy while the wood of river, canoe, and gray birch is light.

Black Locust

This moderate-sized tree (*Robinia pseudoacacia*), also called common or yellow locust and false acacia, grows to a height of 40–60 feet, with a branch spread of 20–35 feet (Fig. 47). Although it prefers an alkaline soil, it grows on a wide variety of soils throughout Illinois. It is frequently used as soil cover to overcome erosion and to reclaim spoil banks and other types of poor soil. It is not used extensively in ornamental plantings because it produces numerous sprouts from roots and is subject to severe damage by the locust borer, ice, and wind.

Black locust produces conspicuous, fragrant, nectar-bearing, perfect white flowers in large pendant clusters which attract insects and birds in the spring. It also produces thin, flat, bright reddish-brown seed pods 3–4 inches long which may be troublesome in lawns. Each seed pod contains 4–8 orange-brown, kidney-shaped, hard seeds approximately ¼ inch long. The large alternate leaves (Fig. 47 inset), which measure 6–10 inches long, are made up of 7–19 smooth, oval leaflets, 1½–2 inches long and dark green above but pale beneath. The scaly, reddish-brown bark is divided into interlacing, fibrous ridges by deep furrows. The heavy, hard, yellowish-brown wood is very durable and is used for fence posts, railroad ties, and many other purposes.

Fig. 47.—Black locust is conspicuous in the spring because of its profusion of white, fragrant flowers. It has large compound leaves (inset).

Buckeye

The Ohio buckeye (*Aesculus glabra*) (Fig. 48) is a native tree which grows along streams and in ravines in the woodlands of Illinois. Occasionally it is used as a specimen tree in ornamental plantings. It is a small tree, reaching a height of 30–40 feet, with a long, round-topped crown.

Each large, opposite, compound leaf (Fig. 48 inset) consists of five long leaflets which are oval in shape, pointed, and with toothed margins. The leaflets are yellow-green on top and paler with fine hairs on the main veins beneath. The large clusters of conspicuous, pale yellow-green, perfect flowers are produced shortly after the leaves are fully grown. The large, round, sharply warty, brown fruits contain from one to three shiny, brown or dark mahogany, smooth seeds which measure 1 inch or more in diameter. The trunk is covered by dark brown to gray, fissured, scaly bark.

Although buckeye is relatively free of insect pests it is susceptible to leaf blotch, a fungus disease that causes the leaves to turn brown and fall prematurely and results in serious defoliation almost every year. However, this disease can be controlled

Fig. 48.—Ohio buckeye is an attractive tree with compound leaves made up of five long leaflets (inset). Its use is limited in ornamental plantings because the leaves are frequently damaged by leaf blotch.

by timely applications of a fungicide such as zineb or ziram. The poisonous nuts and bark should be kept away from cattle. The light wood, although close grained, is weak and soft. Because of its whiteness it may be sold as basswood. It is used in the manufacture of woodenware of various kinds, drawing boards, and paper pulp.

Catalpa

Western (*Catalpa speciosa*) and common (*C. bignonioides*) catalpa (Indian bean) are planted occasionally as specimen trees because of their profuse, showy flowers. Also, catalpa will withstand crowded city and industrial conditions better than many other trees. However, the flowers cover the ground when they fall in the spring, and the long beans or fruits and the large leaves are a nuisance in the fall. Catalpa (Fig. 49) is a tree of moderate height but occasionally it may become exceptionally tall, reaching a height of 80–90 feet.

The heart-shaped leaves (Fig. 49 inset) are either opposite or three-whorled around the branch. The long-pointed leaves of western catalpa are 10–12 inches long and 7–8 inches wide, while

Fig. 49.—Catalpa produces a profusion of white, showy flowers in the spring and long, slender beans in the fall. The leaves (inset) are large and heart shaped.

the shorter leaves of common catalpa are 5–6 inches long and 4–5 inches wide. The light green leaves of common catalpa and the dark green leaves of western catalpa are smooth above and paler and hairy beneath. The perfect flowers are white with bright purple spots, about 2 inches long, and in open, 8-inch clusters. They are several-flowered on western catalpa and many-flowered on common catalpa. The long, slender, beanlike pods have thick walls on western catalpa and thin walls on common catalpa. They measure 8–20 inches long and about ½ inch wide. They contain several light brown seeds, each with fringed wings. The light, grayish-brown bark of catalpa becomes furrowed and rough with age.

Western catalpa, native in the southern half of Illinois, is suited for background plantings in large gardens. It is relatively resistant to injury by ice and wind. Umbrella catalpa, a variety of common catalpa which grows 6–15 feet tall, has an umbrella-like crown. Catalpa trees are frequently attacked and defoliated by the catalpa sphinx. Occasionally they are affected by pow-

dery mildew and leaf spots, but usually very little noticeable injury results. They are more subject to damage caused by Verticillium wilt, a fungus disease. The light brown, coarse-grained wood of catalpa is light and soft. It is used mostly for rough work and occasionally for furniture and the interiors of houses. Catalpa for fence posts has been greatly overrated.

Cherry

Chokecherry (*Prunus virginiana*) and wild black cherry (*P. serotina*) are native to Illinois. Chokecherry occurs in the northern half and wild black cherry occurs throughout the state. Chokecherry is a small tree which grows 20–30 feet high.

Wild black cherry (Fig. 50) sometimes reaches a height of 80–90 feet. It has a narrow crown with small, horizontal branches, and is suitable for street and lawn plantings. The alternate, sharply toothed, dark green, firm leaves (Fig. 50 inset), 2–6 inches long and slightly over an inch wide, are shiny above and dull beneath. The perfect, white flowers are produced in 4- to 6-inch-long clusters. The hard, pitted cherries, which measure about one-third inch in diameter, are dark red to almost black

Fig. 50.—Wild black cherry, with its sharply toothed, leathery leaves (inset), is suitable as an occasional tree in street and lawn plantings.

when ripe. The dark red-brown to almost black bark is thin and smooth, and has horizontal, slitlike, corky areas at first, but breaks into rough, scaly plates with age.

Cherry trees are seldom seriously damaged by diseases or insect pests. However, hydrocyanic acid (HCN) forms in wilting leaves and is poisonous to livestock. The light, hard, strong, close-grained, light brown wood of wild black cherry is excellent for making fine cabinet articles and for interior finish work of houses. The wood of chokecherry is of little commercial value.

Chestnut

Of the three native chestnuts in the United States, only American chestnut (*Castanea dentata*) is native to Illinois. American chestnut (Fig. 51), a broad, round-topped, bulky tree that reaches a height of 60 feet, is grown to a limited extent in orchards. It prefers an acid soil.

The 6- to 8-inch, thin, oblong, lance-shaped alternate leaves (Fig. 51 inset) are sharply pointed, coarsely and very sharply toothed, dark green above, and pale yellow beneath. The white flowers are borne on two kinds of catkins on the same tree and

Fig. 51.—American chestnut, with its sharply toothed, oblong, lance-shaped leaves (inset), has practically disappeared from the American landscape because of the scourge of chestnut blight.

appear in late June or July. One kind is erect, stalked, 6–8 inches long, and bears male flowers. The other kind bears two to five perfect flowers in clusters near the bases of slender, hairy catkins, 2½–5 inches long. The large, globular, brown bur is densely covered with long, branched, sharp spines. It splits open into four parts to expose from one to three sweet, reddish- to lustrous-brown, edible nuts, each ¾–1 inch long and having a sharp, hairy tip. The grayish-brown bark is divided by shallow fissures into broad, flat ridges which often are arranged spirally around the trunk.

Because of chestnut blight, a fungus disease, American and Spanish (*C. sativa*) chestnuts are not recommended for ornamental plantings. Japanese (*C. crenata*) and Chinese (*C. mollissima*) chestnuts are resistant to chestnut blight and are used occasionally in lawn, park, and street plantings. However, the Asiatic chestnuts are susceptible to oak wilt, which is serious and widespread in Illinois. The light, soft, coarse-grained wood of American chestnut is durable in the soil and is suitable for fence posts, poles, and railroad ties. It is useful also for interior finishing of houses and is highly prized by some for making furniture.

Coffee Tree

Kentucky coffee tree (*Gymnocladus dioicus*), sometimes called coffeenut or mahogany, is found mostly in rich bottomlands in Illinois. It is hardy in Illinois and may be used occasionally as a specimen tree (Fig. 52) on wide lawns. It grows vigorously, reaching a height of 80–90 feet, with 3–4 upright main stems which form a narrow, round-topped crown. The stubby branches give the tree a distinctive winter silhouette and make it relatively resistant to damage caused by ice and wind.

The large, alternate, doubly compound leaves (Fig. 52 inset), 2–3 feet long, have numerous smooth, dark green, egg-shaped leaflets 2–2½ inches long and 1 inch wide. The greenish-white male and female flowers are produced separately on the same tree. The male flowers are in clusters 3–4 inches long and the female flowers are in clusters 10–12 inches long. The hard-shelled, dark brown seeds are produced in brown, thick, flat, bulky pods 3–6 inches long and 1–2 inches wide which remain on the tree over winter. The seeds remain viable for several years in the soil. The red-tinted, dark gray bark is curiously ridged with thin, scaly flakes attached at the sides.

Kentucky coffee tree is unusually free of diseases and insect

Fig. 52. — The fast-growing Kentucky coffee tree, with its doubly compound leaves (inset), has conspicuous bark that is very rough and scaly.

pests. The coarse-grained, heavy wood is strong and durable, but it is not very hard. It has very little commercial value, although it is used to some extent for fence posts and rough timbers, and occasionally in cabinet making.

Cork Tree

Amur cork tree (*Phellodendron amurense*), introduced into the United States from eastern Asia about 1856, is a low-growing tree with wide-spreading branches and aromatic wood (Fig. 53). It is called cork tree because of the corky appearance of its deeply fissured, light gray bark. It grows to a height of 40–50 feet with a branch spread of 30 feet. It is drought resistant and is recommended for ornamental plantings in the northern two-thirds of Illinois.

The opposite, compound leaves (Fig. 53 inset) are composed of 5–13 egg-shaped to elongate, finely toothed, sharp-pointed, 2- to 4-inch-long leaflets which are dark green above and paler beneath. The leaflets are attached to a winged midrib. The leaves turn yellow in autumn. The small, yellowish-green, inconspicuous flowers appear in June and are produced in terminal clusters

Fig. 53. — Amur cork tree has conspicuous deeply fissured bark that appears corky. The compound leaves (inset) are unusual because of the wing- or flange-like appearance of the midribs.

2–8 inches high. Male and female flowers are produced on separate trees. The black fruit, up to ½ inch in diameter, has a strong turpentine-like odor when bruised and contains five small, one-seeded stones. It ripens in September and October. Amur cork tree is tolerant of city conditions and is relatively free of diseases and insect pests. The wood is very soft and subject to storm damage.

Crabapple

The native crabapple (*Malus ioensis*) (Fig. 54) is a small, spiny tree that grows throughout the state and produces flowers in the spring. The alternate, egg-shaped to oblong, sharply toothed or sometimes shallowly lobed, firm leaves (Fig. 54 inset) are shiny and dark green above and pale yellow and somewhat hairy beneath. They measure 2½–4 inches long and 1–1½ inches wide. The perfect flowers with their pink to rosy petals are 1–2 inches broad and borne in clusters of three to six. The green to greenish-yellow, globe-shaped fruit is ¾–1½ inches in diameter. The thin bark is scaly and red to brown.

A variety of this crabapple, Bechtal crab (*M. ioensis plena*),

Fig. 51.—The small, low-growing crabapple is used extensively in ornamental plantings. The various species and horticultural varieties have flowers ranging from white through pink to red. Inset shows a sharply toothed leaf.

is used widely as a decorative tree because of the showy appearance of its large, double, rosy-pink blossoms. Several introduced and naturalized species and horticultural varieties, especially of Asiatic origin, are grown for their decorative value. They have flowers ranging from white through pink to red, and fruits ranging from yellow through orange and red to purple. Some varieties have red to purple foliage.

Crabapples are small trees with a branch spread of 20–30 feet and reach a height of 20–30 feet. They are useful for specimen trees and border plantings, and are suitable for plantings around one-story buildings. They are relatively resistant to injury from ice and wind. Asiatic species are relatively free from attack by diseases and insect pests, and are preferred for ornamental purposes because the native crabapples may be severely damaged by several diseases and insect pests. The more detructive diseases are the rusts, fire blight, and scab. Insects which may severely damage crabapples include the yellow-necked caterpillar, hawthorn leaf miner, wooly hawthorn aphid, and San Jose scale. European red mites frequently damage crabapples. The wood of crabapples is of little commercial value.

Dogwood

Of the several species of dogwood native to the United States, only four attain tree size and only two of these are common in Illinois—flowering dogwood (*Cornus florida*) and alternate-leaved or pagoda dogwood (*C. alternifolia*). The introduced cornelian cherry (*C. mas*) and flowering dogwood are recommended for landscape purposes. These dogwoods grow to a height of 20–25 feet, with a branch spread of 15–25 feet. They grow best in rich soil.

In Illinois, flowering dogwood is common in the woodlands south of a line through Hancock, Mason, Piatt, Champaign, and Vermilion counties. Alternate-leaved dogwood occurs in the northern part of the state, extending southward into Vermilion and Champaign counties. South of this area, it is recorded from Adams, Pike, Calhoun, Coles, Clark, Jackson, Union, Alexander, and Pope counties. In woodlands, dogwood grows as an understory tree or as a shrub.

Flowering dogwood (Fig. 55), which prefers an acid soil, is the most widely grown dogwood and it is valued especially because of its showy, early-spring flowers. It produces a low-

Fig. 55. — Flowering dogwood is a small tree valued for its showy, early-spring flowers. The oval-shaped firm leaves (inset) are bright green above and pale green beneath.

spreading head of horizontal, tiered branches. The opposite, oval, minutely hairy, firm leaves (Fig. 55 inset) are bright green above and pale green beneath. They are 3–6 inches long and 1–2 inches wide. The fragrant, nectar-producing, small, greenish-white or yellow, perfect flowers open before the leaves appear. They develop in dense, flat-topped heads which are surrounded by four white or occasionally pinkish, flower-like cups. The entire structure is 3–4 inches across and appears as a single flower. The oval, bright red fruit, about ½ inch long and ¼ inch wide, contains one or two pale brown seeds. The thin, reddish bark is broken by deep fissures into small, square blocks, giving an effect similar to that of alligator hide.

The alternate-leaved dogwood differs from most dogwoods because of its alternate leaves. The leaves are similar in size but more slender than the leaves of flowering dogwood. The small, creamy-white flowers appear in May and June as loose, branched heads on the tips of lateral branches. The dark blue, globular fruits ripen in October. They are nearly ½ inch in diameter and are produced in loose, spreading, reddish-stemmed clusters. The reddish-brown bark is smooth, or shallowly fissured, and rigid.

The cornelian cherry, one of the earliest flowering trees, has its branches wreathed with ¾–inch-long clusters of tiny yellow flowers which appear before the leaves. The opposite, egg-shaped, sharp-tipped leaves, 1½–4 inches long, are lustrous above with short, downy hair beneath. The oblong, scarlet, ¾-inch-long, edible fruit, which ripens in August, is hidden by the leaves. The dark brown bark becomes rough with age. The flaking of small patches exposes a gray undersurface.

Flowering dogwood is subject to a destructive fungus disease called crown canker which occurs in the eastern part of the United States but which has not been reported in Illinois. The hard, brown, close-grained wood is used to some extent in industry.

Elm

Four native species, American or white elm (*Ulmus americana*), rock or cork elm (*U. thomasi*), slippery or red elm (*U. fulva*), winged or Wahoo elm (*U. alata*), and several European and Asiatic species of elm are grown for shade and ornamental purposes in Illinois. They grow rapidly in most types of soil and may reach heights of 70–100 feet. Two small elms with unusual shapes occasionally found in ornamental plantings are Camper-

down elm (opposite page 1) and globe elm (Fig. 2). Camperdown elm (*U. glabra camperdowni*) has strong, crooked branches that grow downward to give the tree a weeping appearance. Globe elm (*U. carpinifolia umbraculifera*) has numerous slender branches that grow upward to give the tree a globe appearance.

American elm (opposite page 1 and Fig. 4 and 56) has been extensively planted throughout the state for shade and ornamental purposes and occurs in abundance in woodlands. The pointed-tipped, coarsely toothed, elliptical-shaped, alternate leaves (Fig. 56 inset), 4–6 inches long and 1–3 inches wide, are dark green, smooth and shiny or somewhat rough above but paler and usually soft-hairy beneath. The small, reddish, perfect flowers, borne on slender stalks up to 1 inch long, appear before the leaves in early spring. The ½-inch-long, light green, oval, winged fruit contains a single seed. The thick, rough, ash-gray bark (Fig. 23) is broken into broad ridges separated by deep fissures and is corky white or gray in spots.

The elms, especially American elm, are subject to attack by various insect pests including cankerworms, aphids, scales, bark beetles, leafhoppers, and mites. Of the diseases that affect elms,

Fig. 56. — American elm, with its coarsely toothed, elliptical leaves (inset), has been the most universally planted shade tree in the midwestern states for generations. However, it is being decimated by two diseases, elm phloem necrosis and Dutch elm disease.

Dutch elm disease and phloem necrosis are the most destructive and widespread. Since hundreds of thousands of American elms have been killed by these diseases in Illinois, many people are planting other species for shade and ornamental purposes. However, the American elm is one of the most versatile trees. It is easily propagated and transplanted, it grows rapidly, and it has wide-spreading, high-arched branches desirable for specimen and parkway plantings. The American elm and its varieties and the winged elm are the only elms reported to be susceptible to phloem necrosis.

Asiatic elms, including Chinese and Siberian elms, the Christine Buisman elm, and the Bea Schwarz elm are resistant but not immune to Dutch elm disease. The Christine Buisman and Bea Schwarz elms are selections of *U. carpinifolia*. These resistant elms can be planted in areas where Dutch elm disease abounds, with assurance that they will persist indefinitely and be useful for shade and ornamental purposes. The Chinese elm (*U. parvifolia*) (Fig. 57) is a slower-growing tree than the Siberian elm (*U. pumila*) (Fig. 58). It has small, glossy, deep green leaves, and sturdy branches which withstand wind and ice storms much

Fig. 57.—Chinese elm, with its small, glossy leaves (inset), is a sturdy tree.

Fig. 58.—The fast-growing Siberian elm is frequently severely damaged by wind and ice storms. Its leaves (inset) are larger and less glossy than leaves of Chinese elm.

better than the American, English, and Siberian elms. Seeds are produced in the fall on the Chinese elm.

The heavy, hard, close-grained wood of the elm is relatively tough and is used for many purposes. The wood of the rock elm is resistant to shocks and jars and is used extensively for hockey sticks, farm implement parts, building sills, and other products which are subject to severe strains.

Ginkgo

Ginkgo, sometimes called maidenhair or Kew tree (*Ginkgo biloba*), is a tall, hardy, slow-growing naturalized tree (Fig. 59) with a straight trunk and few branches. It reaches a height of 80–90 feet with a branch spread of 30–50 feet. It tolerates various types of soil but prefers an acid soil, withstands dry weather and heat, persists under city conditions, and is resistant to injury from ice and wind. It is used extensively in ornamental plantings, especially as a street or specimen tree.

The alternate, long-stalked, oddly fan-shaped leaves (Fig. 59 inset) are bright to dull green, firm, often two-lobed, and are 1–2 inches long, 1½–3 inches across, and form in clusters of three to

Fig. 59.—The hardy, slow-growing ginkgo or maidenhair tree has relatively few but sturdy branches and oddly fan-shaped, leathery leaves (inset).

five on short spurs. They turn yellow to gold in the fall. The male and female flowers are borne on separate trees, the male flowers in loose catkins. The yellowish, oval, ill-smelling fruit is 1 inch in diameter and contains an angular, creamy-white, thin-shelled nut. In the nut is a sweet, edible kernel. To avoid the disagreeable odor of the fruit, only male trees should be planted. The gray, rough bark is deeply fissured, distinctive, and picturesque. Ginkgo is exceptionally free of diseases and insect pests.

Goldenrain Tree

Goldenrain tree (*Koelreuteria paniculata*), also called varnish tree, China tree, and pride-of-India, was introduced into the United States from eastern Asia in 1763. This low, wide-spreading, round-headed tree (Fig. 60), with sparingly contorted branches and a crooked trunk, reaches a height of 30 feet and has a branch spread of 30–40 feet. It is recommended for ornamental plantings in the southern two-thirds of the state. This drought-resistant tree prefers an alkaline soil but grows satisfactorily in most soils. It grows best in sunny locations.

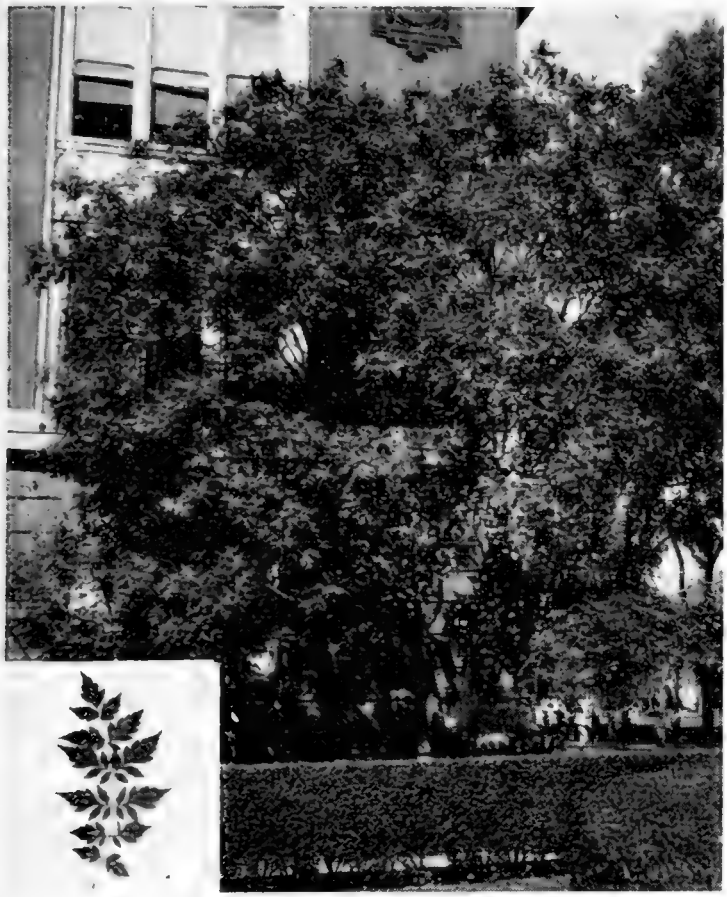

Fig. 60.—Goldenrain tree, with its large, many-leafleted, compound leaves (inset), produces long clusters of bright yellow flowers in the spring and bladder-like pods of fruit in the fall.

The 6- to 14-inch-long, alternate, compound leaves (Fig. 60 inset) are composed of 5–15 round-toothed, egg-shaped to somewhat oblong leaflets 1–3 inches long, dark green and smooth above, and paler beneath. Some leaflets are variously lobed. The broad, loose, 8- to 14-inch-long clusters of bright yellow, perfect flowers are produced in profusion during July and August. Flowers of only one sex are produced on some trees. The 1½- to 2-inch-long, papery-walled, bladder-like pod of fruit contains two black seeds. It changes from light to dark brown as it matures. This tree is relatively free of diseases and insect pests, but is subject to winter injury which frequently develops as frost cracks of the trunk or winter killing of twigs. Recently, it has been reported susceptible to Verticillium wilt.

Hackberry

Hackberry or sugarberry (*Celtis occidentalis*) (Fig. 61) and Mississippi hackberry, also called sugarberry (*C. laevigata*), are native to Illinois. Hackberry is fairly common on rock hills and ridges, and occurs occasionally on low ground. It grows throughout the state and reaches a height of 90 feet with branches spread-

Fig. 61. — Hackberry is relatively free of diseases and insect pests except for witches'-broom. The leaves (inset) are somewhat similar in size and shape to leaves of American elm but are lighter green in color.

ing to 50 feet. Mississippi hackberry grows mostly on bottomlands in the southern third of the state. Hackberry is relatively tolerant of city conditions, and both species are used for shade and ornamental purposes.

The long, thin, sharply pointed, light green, alternate leaves (Fig. 61 inset) are 2–5 inches long and 1½–2 inches wide. The margins are sharply toothed on hackberry and smooth on Mississippi hackberry. The small, cream-colored to greenish flowers are inconspicuous, and male and female flowers are borne separately on the same tree, the female flowers singly and the male flowers in small clusters. The small, round, berry-like fruit measures ¼–⅓ inch in diameter. It is orange-red to yellow on Mississippi hackberry and orange-red, turning to dark purple, on hackberry. The bark of hackberry (Fig. 28) is dark brown and broken up into corky ridges, while the bark of Mississippi hackberry is pale gray and covered with corky warts. Hackberry wood is used mainly for posts and cheap furniture.

Hackberry is relatively free of diseases and insect pests except for witches'-broom. The formation of witches'-broom is associated with a powdery mildew fungus and a gall mite. The

broomlike growths are composed of clusters of dwarfed shoots that grow from swollen or enlarged areas on branches. They are more conspicuous during the winter when the trees are without leaves. No effective cure is known for this trouble. When objectionable, the brooms may be removed by pruning. American hackberry is more susceptible to witches'-broom than Mississippi hackberry.

Hawthorn

Hawthorns, as illustrated opposite page 1 (cockspur thorn) and in Fig. 62 (Washington thorn), are very hardy, small trees. Some hawthorns are used extensively in ornamental plantings because of their showy white, pink, or red flowers and attractive red fruit. The alternate, simple leaves (Fig. 62 inset) are generally toothed and often more or less lobed. They vary on different species from yellowish-green to dark green and shiny. The perfect flowers are produced in small to large groups on the ends of short, leafy, side branches. The round to oblong, dry, mealy fleshed fruit is bright or orange-red in color and is called a

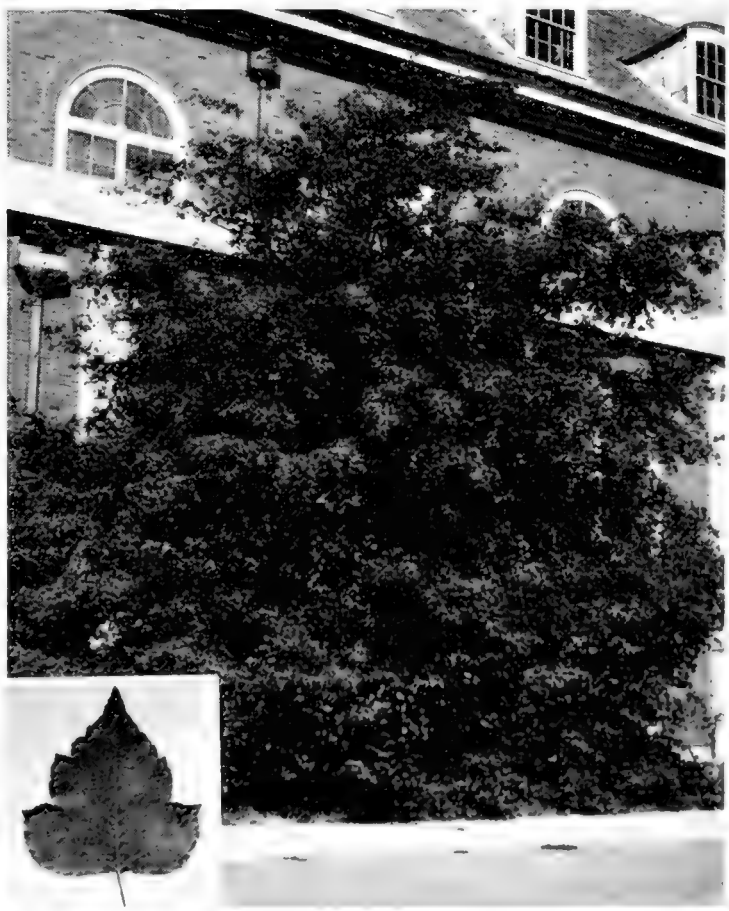

Fig. 62.—Several species of hawthorn are prized as ornamental trees, but in some years they are severely defoliated by the cedar rusts, and individual plants may be damaged or killed by fire blight. Inset shows a toothed and lobed leaf of Washington thorn.

"haw." It contains one to five hard, bony-shelled nutlets. Each nutlet contains a single brown seed.

Hawthorns are shrubby-looking trees with spiny, stout, coarse, ascending or spreading branches and broad, open heads. The short trunks are covered with dark, scaly bark. Although over 100 species have been recorded for Illinois, only a very few are well known. Red haw (*Crataegus mollis*), one of the larger hawthorns, is common in many woodlands in the state. Washington thorn (*C. phaenopyrum*), cockspur thorn (*C. crus-galli*), and English hawthorn (*C. monogyna*) represent the more common hawthorns grown for ornamental purposes. They are excellent for landscaping around one-story buildings. They grow to a height of 15–40 feet with a branch spread of 15–25 feet. However, they may be severely damaged by fire blight or by cedar rusts. They are seldom injured by ice and wind. The hard wood of hawthorn is tough and is used for tool handles, fishing rods, mallets, and other small articles.

Hickory

Hickory is a moderate to large forest tree confined to the eastern part of the North American continent. Of the 15 species which occur in the United States, only 8 are native to Illinois and only 4 of these 8 are suggested for use as occasional specimen trees in ornamental plantings. These are shellbark or shagbark (*Carya ovata*), big shellbark or kingnut (*C. laciniosa*), bitternut or pignut (*C. cordiformis*), and mockernut or white hickory (*C. tomentosa*).

Shellbark hickory (Fig. 63), with its narrow crown and long, stout, ascending branches, grows to a height of 80–90 feet, with a branch spread of 25–30 feet. It is common throughout Illinois and grows on deep, rich soil on low hills, along streams, and near swamps. It prefers an acid soil. The 8- to 14-inch-long, alternate, compound leaves (Fig. 63 inset) are made up of five to seven finely toothed leaflets. The thin but firm, sharp-pointed, elliptical leaflets are 5–7 inches long and 2–3 inches across. They are smooth and dark green above, pale and often hairy beneath, and become rusty-golden-yellow in autumn. Male and female flowers are produced separately on the same tree. Male flowers develop as 4- to 6-inch-long catkins in groups of three. Female flowers develop as two- to five-flowered spikes on the tips of new twigs. The hard-shelled, four-ribbed, nearly globose nut

Fig. 63.—The slow-growing shellbark hickory is a common forest tree that has limited use for ornamental purposes. The compound leaves (inset) have five to seven finely toothed leaflets.

contains a sweet, edible seed. It is covered by a hard husk, ¼–½ inch thick, which splits clean of the nut at maturity. The entire fruit is 1–2½ inches in diameter. The bark on young trees is smooth and gray. On old trees it separates into rough plates 6–8 inches wide and up to 1 foot long with curved tips, presenting a shaggy appearance.

Big shellbark hickory, with its narrow, oblong crown and short, spreading branches, grows to a height of 50–90 feet, with a branch spread of 25–30 feet. It is more common in southern Illinois on low bottomlands subject to spring overflow of rivers, but occurs as far north as Peoria. The large, compound, alternate leaves are made up of five to nine, usually seven, leaflets and measure 15–20 inches long. The sharply pointed, 5- to 9-inch-long, 3- to 5-inch-wide, finely toothed, elliptical leaflets are dark green and lustrous above and soft, hairy, and pale beneath. The flowers are similar to those of shellbark hickory. The hard-shelled, globose, ridged nut contains a chestnut-brown, sweet seed and is covered with a ¼- to ½-inch-thick husk. The entire fruit is 1¼–2½ inches in diameter. The light gray, shaggy bark is simi-

lar to that of the shellbark hickory except that the tips of the bark plates remain flattened against the trunk.

Bitternut, with its rounded, broad-topped crown and stout, ascending branches, grows to a height of 40–65 feet, with a branch spread of 25–30 feet. It grows along streams and on rich bottomlands throughout Illinois. The 6- to 9-inch-long, compound, alternate leaves are made up of seven to nine leaflets. The firm, coarsely toothed leaflets are 4–6 inches long, ¾–1¼ inches wide, smooth and dark green above and paler with hairs on the midrib beneath. They vary in shape from elliptical to lance shaped. The flowers are similar to those of shellbark hickory. The oval to oblong, reddish-gray to brown, thin, brittle-shelled nut with its bitter kernel is encased in a thin, somewhat hairy, globose to oblong husk, ¾–1½ inches long and ⅛ inch or less thick, which bears four wings. The thin, light gray bark of bitternut remains smooth for many years. However, on old trees it forms narrow, firm, interlacing, flaked ridges separated by shallow fissures.

Mockernut grows to a height of 50–80 feet, with a branch spread of 25–30 feet. It develops a narrow, oblong crown of upright, rigid branches or a broad, round-topped crown of graceful and somewhat drooping branches. It grows throughout most of the state but is absent from northern and northeastern counties. It is more common in the south and occurs more often on dry slopes and ridges than on bottomlands. The 8- to 12-inch-long, compound, alternate leaves are made up of five to seven or sometimes nine leaflets. The lustrous, sharply pointed, toothed, oblong to lance-shaped leaflets are 3–7 inches long. The flowers are similar to those of shellbark hickory. The thick, hard-shelled, light reddish-brown nut contains a small, dark brown, sweet seed. It is covered by a strong-scented, reddish-brown, ¼-inch thick husk which splits nearly to the base on ripening. The entire fruit is oval to round or slightly pear shaped and 1¼–2 inches long. The thin, gray bark has low, rounded ridges divided by shallow, irregular furrows.

Hickories are subject to damage from ice, wind, leaf spot diseases, and insect pests, especially the hickory bark beetle. Leaf spot diseases may cause rather severe dropping of leaves or premature defoliation in some years. Usually, however, they are not serious and cause very little noticeable permanent injury. The hard, heavy, strong, close-grained wood of hickory is tough and durable and is one of the most extensively used woods in industry.

Honey Locust

Honey locust (*Gleditsia triacanthos*), which prefers an alkaline soil, is widespread in the state, while water locust (*G. aquatica*) grows only on the swampy bottomlands of the Mississippi, Cache, Ohio, and Wabash rivers in southern Illinois. The typical forms of both species are very thorny and unsuited for ornamental purposes. The thornless form (Fig. 64) of honey locust (*G. triacanthos forma inermis*) grows satisfactorily in various types of soil and is used widely in street and lawn plantings. It grows rapidly, and may reach a height of 70–80 feet, with a branch spread of 60–70 feet.

The large, alternate, compound leaves (Fig. 64, left inset), 7–10 inches long, are composed of 18–28 small, shiny, dark green leaflets which are about 1 inch long and ¼ inch wide. Some leaves are doubly compound (Fig. 64, right inset) and composed of 8–14 singly compound leaves. The inconspicuous, yellowish-green flowers appear in June when the leaves are nearly full grown and are attractive to bees. The male flowers are short, many-flowered, pubescent clusters. The female flowers are slender, single- to few-flowered clusters. Male and female flowers

Fig. 64.—Thornless honey locust has been used extensively where elms have been killed by disease. Its compound leaves (left inset), composed of 18–28 small leaflets, produce light shade. Some leaves are doubly compound (right inset) and composed of 8–14 singly compound leaves.

are borne on the same tree. The dark, reddish-brown fruit develops as a flattened, twisted pod 10–18 inches long and 1–1½ inches wide. Each pod contains several hard, oval seeds embedded in sweet, yellow pulp. Selections of the thornless honey locust which grow very rapidly and do not produce seeds are available. The ½- to ¾-inch-thick bark is divided into long, longitudinal ridges by deep fissures and the surface is roughened by small persistent scales.

Thornless honey locust is relatively free of diseases. However, the foliage may be seriously damaged by bagworm, pod gall, mimosa webworm, and locust mite. The hard, strong, reddish-brown, coarse-grained wood of the honey locust is very durable in contact with the soil. It is used extensively for fence posts and railroad ties and to a limited extent as lumber.

Hop Hornbeam

Hop hornbeam or ironwood (*Ostrya virginiana*) (Fig. 65) is a small, native, slow-growing tree that reaches a height of 25–30 feet with a branch spread of 20–30 feet. Mature trees usually develop open, round-topped crowns of slender branches. It

Fig. 65.—The small, slow-growing hop hornbeam, with its elmlike leaves (inset) and hoplike fruit, is suitable as an occasional tree in ornamental plantings.

occurs throughout Illinois and grows on high banks of streams where it tolerates the shade of oaks and other tall trees. It prefers an acid soil, does not thrive in open, sunny places, and is difficult to transplant.

The smooth, thin, firm, alternate, elmlike leaves (Fig. 65 inset) are 3–5 inches long and 1½–2 inches wide with finely double-toothed margins. Male and female flowers are borne separately on the same tree. The 2-inch-long male flowers form as clusters of reddish-brown catkins from lateral buds near the end of the previous year's twig growth. The pale green, ½- to ¾-inch-long female flowers form as erect spikes or short catkins at the tip of the new growth. The long-stalked, pendulous, hoplike fruit is made up of a number of bladdery sacs with hairs at the base of the papery scale. Each sac encloses a chestnut-brown, pointed, flattened nutlet. The gray to brown, shredded bark appears as narrow, scaly plates which are loose and curled at the free end.

Hop hornbeam is relatively free of destructive diseases and insect pests. The hard, close-grained wood is not durable in the soil. However, because of its strong and tough characteristics it is used for mallets and handles of various tools.

Hornbeam

Hornbeam or blue beech (*Carpinus caroliniana*) (Fig. 66) is a small, slow-growing, bushy tree, with slender, slightly zigzag, spreading, droop-tipped branches, that reaches a height of 35 feet with a branch spread of 15–20 feet. It thrives in partial shade along streams as an understory tree and is used occasionally in ornamental plantings.

The alternate, thin, long-pointed leaves (Fig. 66 inset), with double- toothed margins, are green and smooth above, and light yellow and smooth to finely hairy beneath. They are 2–4 inches long and 1½–2 inches wide. The male and female flowers form as separate catkins on the same tree after the leaves appear. The 1- to 2-inch-long male catkins have egg-shaped, pointed scales which are green below the middle and red above. The ½- to ¾-inch-long, erect, female catkins have hairy, leaflike, green scales. The fruit is a nutlet borne at the base of a three-lobed, leaflike structure. Several of these structures are arranged spirally in a conelike cluster. The smooth, gray bark is occasionally marked with brownish horizontal bands.

No destructive diseases have been reported affecting horn-

Fig. 66.—Hornbeam, with its pointed leaves (inset), is used occasionally in ornamental plantings. It is sometimes called blue beech because its smooth, gray bark resembles the bark of beech.

beam in Illinois. The hard, heavy, close-grained wood is strong and is used to a limited extent in industry.

Horse Chestnut

Horse chestnut (*Aesculus hippocastanum*) is an introduced tree which is grown for shade, ornamental, and specimen purposes. It is a large tree (Fig. 67), growing to a height of 75 feet with a branch spread of 30–40 feet.

The large, compound, opposite leaves (Fig. 67 inset), dark green above, paler beneath, and turning rusty-yellow in the fall, have five to seven leaflets. Each abruptly pointed, irregularly toothed leaflet is wedge shaped and wider toward the tip. The large, 6- to 12-inch-high, showy, chandelier-like flower clusters are white, tinged with red, and appear shortly after the leaves unfold in the spring. They give rise to large, round, spiny fruits. Each fruit contains one or two large, shiny, brown nuts. The dark brown bark breaks up into slowly peeling, thin plates. The red horse chestnut (*A.* x *carnea*) has pink flowers. Many horse chestnuts in Illinois are attacked by a fungus disease called leaf blotch. Large areas of affected leaves are killed by this fungus.

Fig. 67.—Horse chestnut produces showy clusters of red-tinged, white flowers in the spring. Its compound leaves (inset) are frequently killed in late summer by a fungus disease.

Severely affected trees show extensive browning of leaves and premature defoliation in late summer. The weak, soft, whitish wood of the horse chestnut has only limited use, mainly in the manufacture of woodenware.

Juniper

Junipers are small, aromatic evergreen trees with slender branches and small needle- or scalelike leaves. Upright and low, spreading forms are used extensively in ornamental plantings, especially in border plantings and as specimen plants. Occasionally they may be used in windbreaks. Numerous varieties are available for these purposes. The native red cedar (*Juniperus virginiana*) (Fig. 68), which grows throughout Illinois, reaches a height of 20–50 feet. It withstands cold weather, hot and dry weather, and wind and ice storms. It is also tolerant of wet soils. It frequently takes over abandoned fields of barren soil, and it thrives in fence rows where the fruits have been dropped by birds.

The sharp-pointed 1/4- to 3/4-inch-long needle-like leaves develop on young growth or vigorous shoots and are whitened

Fig. 68.—Several species of juniper are small, aromatic evergreen trees suitable for border and specimen plantings. Inset shows a branch tip, with numerous small, needlelike leaves on the lateral shoots.

beneath on older shoots. The dark green, scalelike leaves (Fig. 68 inset), about 1 16 inch long, grow in such a manner that the stems appear square in cross section. Male and female flowers, produced at the ends of twigs, are borne on separate trees in early spring. The conelike male flowers with four to six scales contain an abundance of yellow pollen. The female flowers have violet-colored cone scales which become fleshy and grow together to form a blue, fleshy, globose, berry-like, few-seeded fruit ¼–⅓ inch in diameter. The red-tinted, brown, thin bark peels off in long, narrow, shredlike strips.

Red cedar, Colorado juniper (*J. scopulorum*), and many forms of these two species are susceptible to the rust fungi which frequently damage hawthorn and crabapple. Two pests of junipers which cause severe defoliation in some seasons are bagworm and spruce spider mite. The fragrant, fine-grained wood of red cedar is relatively soft and brittle. However, it is exceedingly durable and is suitable for fence posts, piles, railroad ties, and

other products which must be exposed to water, soil, or the weather.

Katsura Tree

Katsura tree (*Cercidiphyllum japonicum*), introduced into the United States from Japan in 1865, is a pyramidal, 20- to 30-foot-tall tree (Fig. 69), usually with several trunks and slender, ascending branches which later become spreading. In Japan, it may grow to a height of 100 feet. Although it may be used in plantings throughout the state, it grows best in a deep, rich soil that contains plenty of moisture.

The round to somewhat heart-shaped, 2- to 4-inch-long, opposite leaves (Fig. 69 inset) are deep green above and silvery green beneath, turning purplish-red and yellow in autumn. The leaf stalks and veins may be red. The inconspicuous male and female flowers, produced on separate trees, appear before the leaves. The many-winged seeds are produced in ¾-inch-long pods that split open when mature. Katsura trees are relatively free of diseases and insect pests in the United States.

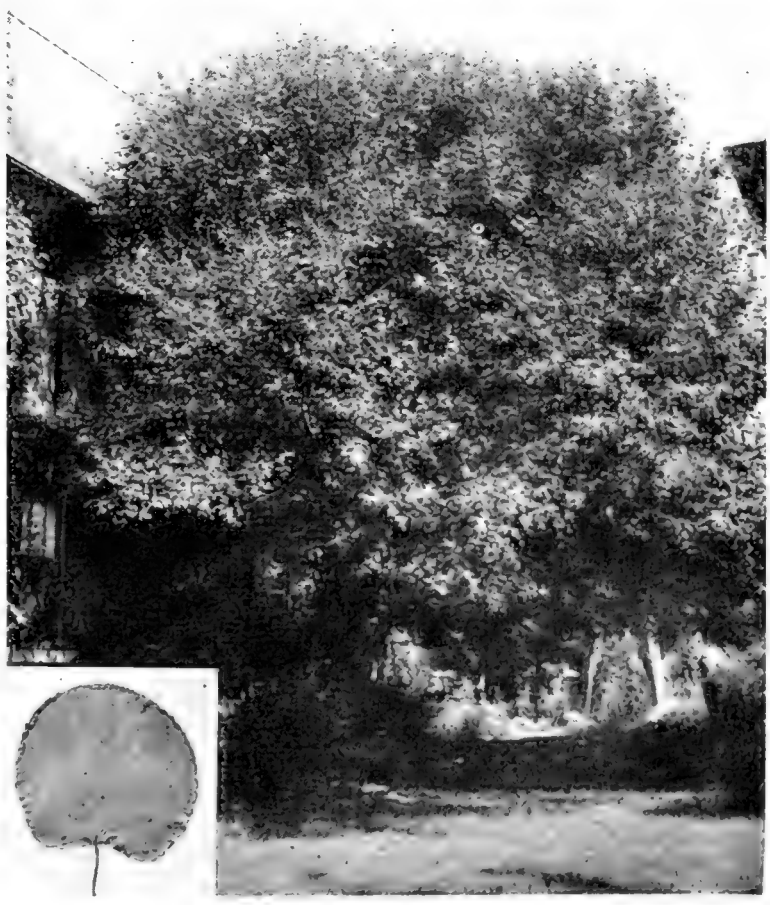

Fig. 69.—The small katsura tree is relatively free of diseases and insect pests in the United States. The tree pictured here was top-pruned beneath power lines. Its round to somewhat heart-shaped leaves (inset) turn yellow to purplish-red in autumn.

Larch

Two larches, tamarack (*Larix laricina*) and European larch (*L. decidua*), are grown in Illinois. They are used in windbreaks and along roadsides, and are graceful trees for specimen and lawn plantings. Tamarack, also called American or eastern larch, grows as a native tree only in McHenry and Lake counties and occurs in the interior of deep sphagnum swamps and bogs. It is tolerant of poor soils, including heavy clay and coarse sand. It is a hardy, straight tree reaching a height of 40–50 feet. The long, drooping branches form an extended, narrow, spikelike crown in the open or a short, open crown when crowded.

The ¾- to 1½-inch-long, sharply pointed, needle-like, pale blue-green leaves are borne in compact bundles of 20–50 at intervals on older twigs and singly in a close spiral on young shoots. They are shed in autumn. The male and female flowers are produced separately on the same tree and appear with the leaves. The globe-shaped, yellow male flowers are produced on lateral branches of 1- or 2-year-old twigs. The oblong female flowers with rose-red, rounded scales are produced at the tips of short, leafy shoots along the sides of 1- to 3-year-old twigs. The ½- to

Fig. 70.—The tall, straight European larch, with its soft, flat leaves (inset), is a graceful specimen tree.

¾-inch-long, somewhat oblong, chestnut-brown cones mature in the autumn of the first year. The 20 or more concave cone scales are nearly rounded and have irregular and shallow-toothed margins. Two terminally winged seeds are borne on each scale. The grayish- to reddish-brown, thin bark is minutely scaly. The brown, coarse-grained wood is fairly durable and resembles the wood of hard pine. It is used for telephone poles, fence posts, and railroad ties.

The tall European larch (Fig. 70), with its horizontal branches, reaches a height of 100 feet. It loses its pyramidal shape with age and becomes irregular. The flat, soft, bright green leaves (Fig. 70 inset) are ¾–1½ inches long. The ¾- to 1¼-inch-long, oval cones are made up of 40–50 scales. The wings of the seeds extend to the upper margin of the scale. The dark, grayish-brown bark is thicker than the bark of tamarack.

The larches are relatively free of diseases and insect pests in Illinois.

Linden

The two native species of linden (basswood) in Illinois are American linden or basswood (*Tilia americana*) and white basswood or beetree linden (*T. heterophylla*). White basswood is rare in the state. Both species are fast-growing trees and have soft, brittle wood. They reach heights of 80–100 feet with a branch spread of 30–60 feet. Native and introduced species of linden are used for shade and specimen purposes in ornamental plantings.

American linden (Fig. 71), which occurs throughout the state, is frequently found on rich, wooded slopes, along moist stream banks, and in cool ravines. The alternate, egg-shaped, broad, lopsided, abruptly pointed leaves (Fig. 71 inset) have coarsely toothed margins. They are 5–6 inches long, 3–4 inches wide, dark dull green on the upper surface, and shiny light green beneath. The clusters of yellowish-white, sweetly fragrant, nectar-bearing, perfect flowers are attractive. The globe-shaped, nutlike fruit is about ½ inch in diameter, woody, and densely hairy on the outside. The branches are smooth with green bark, and the furrowed trunk bark is gray, tough, and fibrous.

The wood of linden is not durable and is not suitable for fence posts, railroad ties, and other rough uses. However, it is used in the manufacture of cheap furniture, boxes, trunks, picture moldings, beekeeper supplies, musical instruments, excelsior,

Fig. 71.—American linden produces conspicuous clusters of yellowish-white, sweetly fragrant flowers. The broad, lopisded leaves (inset) are somewhat heart shaped.

veneer, and paper pulp. The lindens are relatively free of diseases and insect pests. However, an occasional American linden is affected by Verticillium wilt.

Magnolia

Only one magnolia (*Magnolia acuminata*), the cucumber tree or mountain magnolia (Fig. 72), is native to Illinois, occurring in Alexander, Johnson, Pulaski, and Union counties in the southern tip of the state. It is usually pyramidal in shape when growing in the open but may grow columnar in shape when crowded. It is moderate to large in size, at times reaching a height of 80–90 feet and a branch spread of 40–45 feet. It is resistant to injury from ice and wind.

The very large, dark green, broadly elliptical leaves (Fig. 72 inset) are 6–10 inches long and 4–6 inches wide. They are smooth above and smooth or hairy beneath, and the margins are smooth or slightly warty. This tree and two introduced magnolias, the sweet bay (*M. virginiana*) and saucer magnolia (*M. soulangeana*) (Fig. 73), are used as specimen plants. Sweet bay and saucer magnolia are small trees or large shrubs.

Fig. 72.—Cucumber tree or mountain magnolia has large, smooth leaves (inset) and bell-shaped, greenish-yellow, inconspicuous flowers.

Fig. 73. — The shrublike saucer magnolia, with its large leaves (inset), is prized for its large, conspicuous, purplish or rose-colored flowers which appear in early spring.

Magnolias grow most luxuriantly in loose, rich, moist, acid soil. The large, elliptical to oblong, 2½- to 8-inch-long, alternate leaves of saucer magnolia (Fig. 73 inset) are dark green and smooth above and lighter green and smooth or hairy below. The 2- to 3-inch-wide, white, waterlily-like, fragrant flowers of sweet bay and the 4- to 6-inch-wide, purplish or rose-colored flowers of saucer magnolia are conspicuous, while the 2- to 3-inch-long, bellshaped, greenish-yellow flowers of cucumber tree are hidden by the foliage. The conspicuous, conelike, 2½- to 3-inch-long, red fruits contain bright red seeds. However, the immature fruits are green and resemble a cucumber, hence the name cucumber tree. The trunk bark of cucumber tree is dark brown, furrowed, and scaly, while the trunk bark of sweet bay and saucer magnolia is grayish-brown and smooth.

The magnolias are relatively free of diseases and insect pests. However, an occasional tree is affected by Verticillium wilt or infested with scale insects. The yellowish-brown, close-grained wood is not hard or strong and is not used extensively in industry.

Maple

The five species of maple native to Illinois are sugar or hard maple (*Acer saccharum*) (Fig. 74), black maple (*A. nigrum*), silver or soft maple (*A. saccharinum*) (Fig. 75), red or scarlet maple (*A. rubrum*), and boxelder or ash-leaved maple (*A. negundo*). All but boxelder reach heights of 80–90 feet or more and a branch spread of 50–80 feet. Boxelder usually does not grow over 50 feet tall with a branch spread of 30–50 feet. These species, with several of their varieties, and several European and Asiatic species, are used extensively in ornamental plantings.

The leaves, except on boxelder, are simple, three- to five-lobed, opposite, and borne on long slender stalks which are 2–4 inches long in red maple and 4–5 inches long in silver maple. The leaves of boxelder are compound with three to five irregularly toothed leaflets with pointed tips. The lobes of silver maple leaves (Fig. 75 inset) are deep with long points, and those of the other three maples are shallow. Leaves of sugar maple (Fig. 74 inset) and black maple are dark green above and paler beneath, while the leaves of red and silver maple are light green above and whitish to silvery-white beneath.

Fall color in maples varies from yellow to scarlet. The flowers are produced in clusters from lateral or terminal flower buds. They may be perfect or the male and female flowers may be pro-

Fig. 74.—The slow-growing, sturdy, sugar maple is prized for the autumn color of its five-lobed leaves (inset), which varies from bright yellow to brilliant scarlet.

Fig. 75.—The fast-growing silver maple produces long, slender branches that are easily broken by wind and ice. The leaves (inset) are more deeply lobed than the leaves of sugar maple.

duced separately on the same tree or on separate trees. The flowers of boxelder are regularly produced on separate trees. The U- or V-shaped fruit, known commonly as "maple keys," and composed of two single-winged seeds, is produced in late spring on red and silver maple and in autumn on sugar and black maple and boxelder. The bark of maples varies from light gray to dark brown or black. It is fissured and rough on boxelder, sugar, and black maple and scaly on red and silver maple.

The rapidly growing Norway maple (*A. platanoides*), with its broad, dense head, dark bark, and foliage similar to sugar maple, is planted widely along streets and in lawns and parks. However, its dense shade prevents good growth of lawn grasses. It may reach a height of 90 feet with a branch spread of 40–60 feet. The slow-growing sugar maple is planted extensively as a street, lawn, and specimen tree and is also a woodland tree. It is resistant to injury from ice and wind. Several varieties of sugar maple, especially those of columnar habit, are well adapted for planting along narrow streets. The brittle wood of the rapidly growing silver maple and boxelder is easily broken by wind and ice. Silver maple also may be severely damaged by infestations of cottony maple scale, and the leaves are frequently deformed by the maple bladder-gall mite. Verticillium wilt is the most destructive disease of maples and it most frequently affects Norway and sugar maples in Illinois.

Silver maple and boxelder have relatively little economic value for wood products. Sugar maple has hard, fine-grained, heavy wood. It is one of the most valuable Illinois hardwoods and is used in the manufacture of numerous products including furniture, flooring, farm implements, muscial instruments, boxes, crates, toys, trunks, and veneer. The highly decorative "birdseye" maple used in paneling for walls, cabinets, and beds, and the ornamental "curly" maple used extensively in cabinets, are obtained from sugar maple. Maple sugar and maple syrup are made from sugar maple sap and can be made from boxelder sap.

Mountain Ash

American mountain ash (*Sorbus americana*) and European mountain ash, sometimes called rowan tree, (*S. aucuparia*) (Fig. 76) are small, round-headed trees which grow to heights of 25–35 feet. They are attractive in ornamental plantings because of their small size, compound leaves, white flowers, and showy orange to red fruits.

Fig. 76.—European mountain ash produces attractive white flowers in the spring and showy orange to red fruit in autumn. Each compound leaf (inset) is composed of 9–15 leaflets.

The yellowish-green, alternate, compound leaves of American mountain ash are 6–10 inches long and consist of 13–17 sharply pointed, finely toothed, oblong to lance-shaped leaflets. The dense flat-topped clusters of small white flowers, 3–5 inches wide, appear before the leaves are fully grown. The round, bright, orange-red, fleshy fruit is about ¼ inch in diameter and it contains a ⅛-inch-long, brown seed. The gray bark is thin and smooth.

The leaves, flowers, and fruit of European mountain ash are similar to those of American mountain ash. However, the compounds leaves (Fig. 76 inset) consist of only 9–15 oblong leaflets and the flowers and bright orange fruits are more showy. Both trees thrive in most soils, but American mountain ash grows best in loamy, acid soil and in cool locations. European mountain ash is planted more extensively than American mountain ash because it is more shapely and produces more brilliantly colored fruit, but it appears to be more susceptible to the bacterial disease called fire blight.

Mulberry

The red or American mulberry (*Morus rubra*) is native to America. However, the white mulberry (*M. alba*) was introduced from eastern Asia in colonial times when there was an attempt to establish the silkworm industry in the United States. Red, white, and Russian mulberry (*M. alba tatarica*), a variety of the white mulberry, are used occasionally in ornamental plantings. However, their large, juicy fruits, which are attractive to birds, insects, and other animals, become very messy when they fall to the ground.

Red mulberry is a dense, broad, round-topped, fast-growing tree with stout, spreading branches that are resistant to injury by ice and wind. It reaches a height of 40–60 feet. It grows best on rich, moist soils. The thin, bluish-green, oval to nearly circular or somewhat heart-shaped, alternate leaves are entire to three-lobed and 3–5 inches long and 2½–4 inches wide. Some leaves with single lobes are mitten shaped. They are smooth to somewhat roughened above, pale and more or less hairy beneath, and have coarse, incurved teeth along the margins. The leaf stems contain a milky sap. Male and female flowers, which appear as the leaves unfold, may be borne on separate trees or on the same tree—the male flowers as 2-inch-long, narrow catkins, and the female flowers as 1-inch-long, hanging spikes on short, hairy stalks. The long, narrow, dark red to purple, sweet, juicy, edible fruit is over an inch long and hangs by a short stalk. The red-tinted, brown, rather thin bark peels off in long, narrow plates or flakes. Red mulberry is relatively free of diseases but many insects, especially caterpillars, feed on the leaves. The soft, coarse-grained, golden-brown wood is sufficiently tough and durable to be used as fence posts.

White mulberry (Fig. 77) is a small, round-headed tree, with wide-spreading branches, which grows to a height of 50 feet. The small, thin, broadly egg-shaped, alternate leaves (Fig. 77 insets), 2½–7 inches long, are light green and smooth above and slightly hairy beneath. The pointed-topped and rounded or heart-shaped leaves often have one to five lobes and are smooth except for hair on the veins. The margins are coarsely toothed. The small, greenish flowers are similar to those of red mulberry. The sweet but insipid fruit is ½–1 inch long and white to pink or purplish violet. The bark has more of a yellowish tinge, especially in the furrows, than the bark of red mulberry.

Russian mulberry is a hardy, small, bushy tree which grows

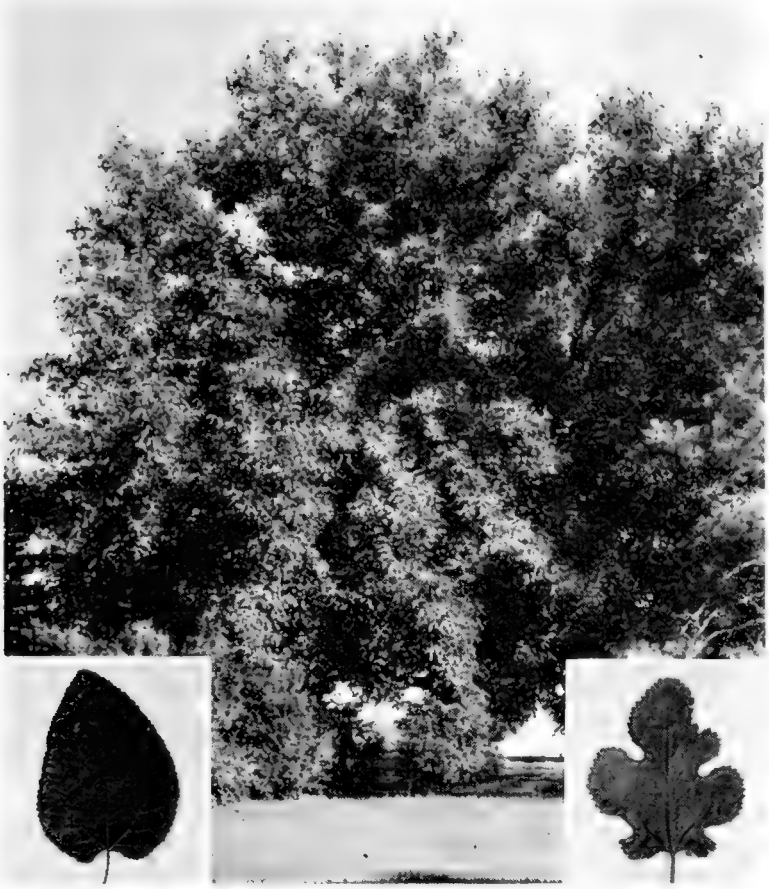

Fig. 77.—Mulberry (white mulberry pictured here) is useful in ornamental plantings where its messy fruit is not objectionable. It has variable-shaped leaves (insets); some are without lobes while others on the same tree may have one to five lobes.

to a height of 20–30 feet with a branch spread of 30–40 feet. It withstands dry conditions but is subject to winter injury. It is hardy in Illinois and is recommended for trial planting. The dark green, alternate leaves are entire to much-lobed and 1½–3 inches long. The flowers are similar to those of red mulberry. The dark red or sometimes white fruits are about ½ inch long. This tree is recommended for ornamental plantings because of its hardy characteristics.

Oak

Oak is valued highly for shade and ornamental purposes in lawn, parkway, and park plantings. In recent years many new housing developments have been built in established oak plantings and the trees are highly prized by the homeowners. However, oak trees frequently do not survive the injuries to which they are subjected in the development of homesites. Injuries to trunks and roots often result from soil excavations, grade changes, and changing of water levels in the soil.

All native species of oak except white (*Quercus alba*) and swamp white (*Q. bicolor*) prefer an acid soil. Pin oak (*Q. palus-*

tris) is probably the species most sensitive to soil reaction. Its leaves frequently become yellow between the veins when the soil is above pH 6.7. This yellowing of foliage, called chlorosis, is most commonly associated with iron deficiency in Illinois. Chlorosis is described in detail in Illinois Natural History Survey Circular 46.

The oaks are well known for their interesting fruit, the acorn. The various species of oak are usually divided into two major groups, the white oaks and the black oaks. These two groups are easily distinguished by their leaves. The white oak group has leaves with rounded, bristle-free lobes. The black oak group has leaves with bristle-tipped lobes that are not rounded, or leaves that are entire with bristles at the tip.

Of the 18 species of oak native to Illinois, most are relatively large trees which grow to heights of 50–90 feet. The blackjack oak (*Q. marilandica*), commonly called scrub oak, is a small tree. It reaches a height of 20–40 feet and may grow shrublike in appearance. It has an open, narrow, round-topped crown with drooping branches.

Pin oak (*Q. palustris*) (Fig. 78), used extensively for

Fig. 78.—The moderately large pin oak grows more rapidly than most other oaks. Its leaves (inset) have five to seven deep, sharp-pointed lobes.

shade and ornamental purposes, grows to a height of 70–80 feet. However, it is subject to chlorosis as described above. It is a moderately large tree which grows more rapidly and is more easily transplanted than other species of oak. It produces numerous, slender branches that are usually pendulous at the ends. The alternate leaves (Fig. 78 inset) are dark green, with five to seven deep lobes, and measure 4–6 inches long and 2–4 inches wide. They are shiny above and paler, with tufts of pale hairs in the axils of the large veins, below. The male and female flowers are produced separately on the same tree. The male flowers are produced as 2- to 3-inch-long catkins and the female flowers are short, reddish, hairy spikes, often in pairs. The small, ½-inch-long, globe-shaped, bitter-kernelled acorn is enclosed one-third of the way with a thin saucer-shaped cup. The trunk, usually not over 2–3 feet in diameter, is generally covered with smooth, gray to dark brown bark.

Other oaks used rather extensively in shade and ornamental plantings are red oak (*Q. borealis*), white oak (*Q. alba*), and bur oak (*Q. macrocarpa*). Red oak (Fig. 79) is a large tree with a narrow crown of stout branches. It grows to a height of 80–90

Fig. 79.—Red oak, a sturdy tree, is similar to pin oak in rate of growth. The leaves have 7–11 lobes and each lobe is bristle tipped.

feet. The smooth, alternate leaves (Fig. 79 inset) are divided almost halfway to the midribs into 7–11 lobes, and usually each lobe has three smaller, bristle-tipped lobes. The leaves are dull green above, yellow-green below, and from 5 to 9 inches long and 4 to 6 inches wide. The 4- to 5-inch-long male catkins and the short, hairy female spikes are borne separately on the same tree. The female flowers are borne in the axils of the new leaves. The 1-inch-long, oblong acorn is somewhat hairy at the cup end. The bitter-kernelled nut is one-fourth to one-third enclosed by a saucer-shaped cup. The trunk bark is dark brown and is fissured into low, continuous, flat-topped ridges. Red oak is one of the faster-growing oaks. It is resistant to injury by ice and wind and is relatively easy to transplant. It is useful as a specimen or lawn tree and in large gardens and wide parkways.

White oak (Fig. 80) is a large tree with stout branches that are resistant to injury by ice and wind. It grows to a height of 80–100 feet. The smooth, alternate leaves (Fig. 80 inset), bright green above and pale green below, are shallow to deeply lobed, with seven to nine lobes. They are 5–9 inches long and 2–4 inches wide. The young unfolding leaves are soft silver-gray to red and hairy below. The 2½- to 3-inch-long, hairy male catkins and the short, bright red, inconspicuous female spikes are produced separately on the same tree, the female spikes being produced at the base of the new leaves. The shiny, light brown, oval, ¾-inch-long acorns are one-fourth enclosed in shallow cups covered with warty scales. The cups are attached to 1- to 2-inch-long stalks or directly to the twigs. The trunk bark is light gray to nearly white and is divided by shallow fissures into long, irregular, thin scales. White oak is difficult to transplant and grows very slowly. However, it is an excellent shade tree and is prized in ornamental plantings.

Bur oak (Fig. 81) is a moderately large tree with a broad crown of massive, spreading branches that are resistant to injury by ice and wind. It usually grows to a height of 60–70 feet but may approach 100 feet. It thrives throughout the state, growing in the sands of the north, in the gravelly moraines of the central part, and in the bottomlands of the north and south. It has thick, lustrous, five- to seven-lobed, alternate leaves (Fig. 81 inset) that are 6–12 inches long and 3–6 inches wide. The leaves expand from a wedge-shaped base to a very large and wavy-toothed end lobe. They are deep green above and pale green and hairy beneath. The 4- to 6-inch-long, white-wooly male catkins and the

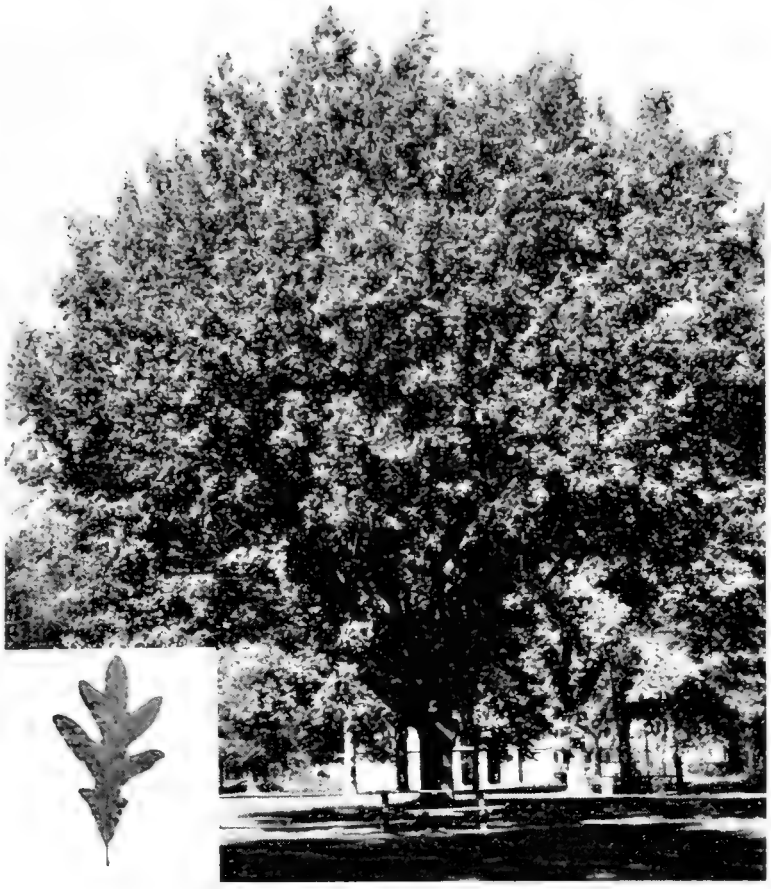

Fig. 80.—The large, slow-growing, sturdy white oak is an excellent tree for shade and ornamental purposes. Its leaves (inset) have seven to nine shallow to deep, somewhat round-tipped, lobes.

Fig. 81.—Bur oak grows more rapidly than white oak, although not as fast as pin and red oak. The leaves (inset) are thick and lustrous and have round-tipped lobes.

short female spikes, produced separately on the same tree, stand on slender, wooly stems. The ¾- to 1½-inch-long, dark chestnut-brown acorns are one-third to one-half covered with a thin cup supported on a ½-inch-long, stout stalk. The pale brown trunk bark is deeply furrowed and plated. The branches are unusual because of the ribbed and corky formation of bark. Bur oak grows more rapidly and is more easily transplanted than white oak. It is highly prized as a shade and ornamental tree.

The other native oak species in Illinois are used occasionally for shade or specimen purposes. Species such as black oak (*Q. velutina*), chinquapin oak (*Q. muhlenbergii*), scarlet oak (*Q. coccinea*), basket oak (*Q. prinus*), shingle oak (*Q. imbricaria*), and willow oak (*Q. phellos*) are available at some commercial nurseries.

Although oaks are occasionally attacked by insects, including periodical cicada, oak kermes, leaf miners, and gall-producing insects, the amount of damage caused is usually limited or localized and does not warrant annual treatment for insect control. Oak wilt is the only widespread and destructive disease of oaks in Illinois. However, this fungus disease occurs mainly among trees in forest and woodlot plantings and generally is not a serious threat to the sparsely planted oaks in ornamental plantings, especially where oaks are not growing close enough to one another for their roots to become grafted. Spread of the oak wilt fungus occurs most readily through grafted roots between adjacent trees.

Oak is the principal hardwood tree used in the wood industry. Most species of oak have strong, close-grained, tough, durable wood that is suitable for a wide variety of uses, including fence posts, railroad ties, mine timbers, barrels, furniture, interior finishing, and fuel.

Osage Orange

Osage orange (*Maclura pomifera*) (Fig. 82), sometimes called bow wood or hedge tree, with its round-topped crown of spiny, uptilted, spreading branches, grows to a height of 30 feet in the open and 50–60 feet when crowded. This tree is widely distributed in the United States. However, its native range is from southern Arkansas and Oklahoma southward into Texas. Although this tree has been used extensively for farm hedges throughout the state, it prefers rich bottomland.

The oval, alternate leaves (Fig. 82 inset), each with an

Fig. 82.—Osage orange, formerly used extensively for farm hedges, produces large, yellowish-green fruit. The fruit and the shiny, oval-shaped leaves (inset) exude a milky juice when crushed.

abruptly narrowed tip, have smooth margins and are 3–5 inches long and 2–3 inches wide. The male and female flowers are produced on separate trees, the male flowers in clusters 1–1½ inches long, and the female flowers in globelike heads ¾–1 inch in diameter. The ball-shaped, yellowish-green, fleshy fruit, sometimes called hedge apple, is 4–5 inches in diameter by the time it ripens in autumn. The leaves and fruits exude a sticky, milky sap when bruised or crushed. The dark orange, deeply fissured bark forms into broad, rounded ridges.

The bright orange, coarse-grained wood is exceedingly hard and durable and makes excellent bows, fence posts, and railroad ties. Osage orange is exceptionally free of diseases, requires very little pruning, and seldom is damaged by wind and ice. However, its foliage is relished by some caterpillars.

Pagoda Tree

Japanese pagoda tree or Chinese scholar tree (*Sophora japonica*) (Fig. 83), introduced into the United States from eastern Asia in 1747, is a dense, round-headed tree with spreading branches. It reaches a height of 60–70 feet, with a branch

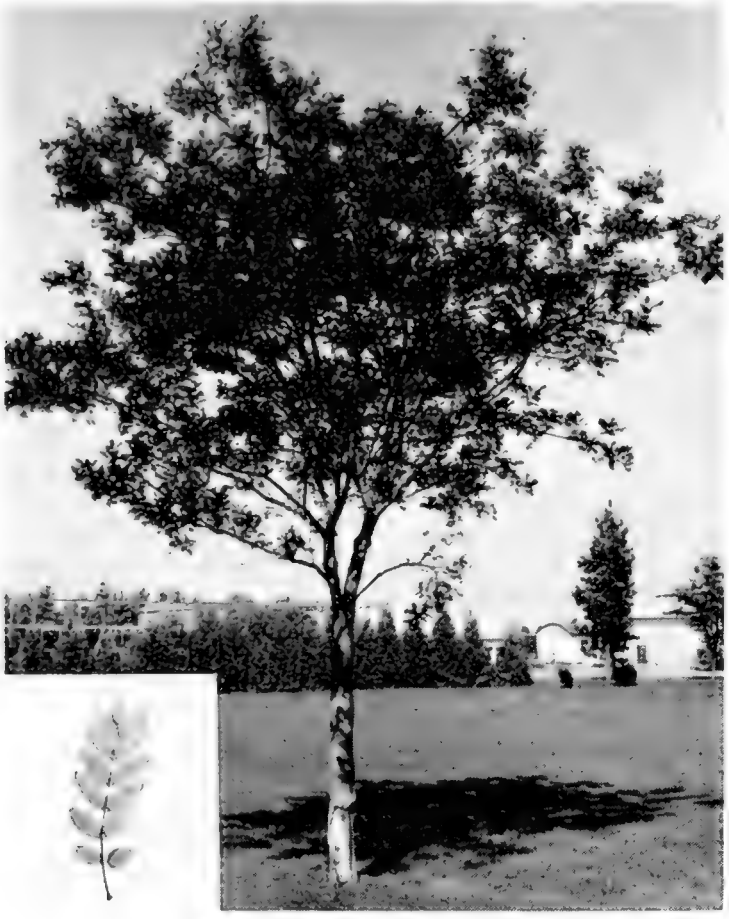

Fig. 83. — Japanese pagoda tree produces showy clusters of pea-like, creamy-white flowers in July. The compound leaves (inset) are composed of 7–17 leaflets 1–2 inches long.

spread of 40–60 feet. It thrives in most soils and is suitable for city plantings and specimen trees on lawns in the southern two-thirds of Illinois.

The odd, feather-like, compound, 6- to 10-inch-long leaves (Fig. 83 inset) have 7–17 narrowly oval, opposite leaflets 1–2 inches long. The leaflets are dark green and lustrous above and more or less hairy or fuzzy beneath. The pea-like, creamy-white, 6- to 10-inch-long, showy clusters of perfect flowers appear in July. The fruit is a few- to many-seeded pod 2–3 inches long, ⅓ inch across, and constricted between seeds. The fissured bark on the trunk is grayish brown while the smooth or nearly smooth bark on the twigs is dark green. Pagoda trees are relatively free of diseases and insect pests. However, an occasional tree is affected by Verticillium wilt.

Pawpaw

The native pawpaw (*Asimina triloba*) (Fig. 84) is a small, fast-growing tree that usually does not exceed 20 feet in height but may occasionally reach 30–40 feet, with a branch spread of

Fig. 84.—Pawpaw is noted for its attractive flowers and nutritious fruit. The smooth, oblong leaves (inset) are sharply pointed. This picture shows a clump planting.

15–30 feet. It grows in deep, moist soils as an understory tree, frequently in thickets, in deep woods throughout Illinois except for the northern tier of counties. It produces a central leader with small, spreading branches. Pawpaw, used to a limited extent in decorative plantings, has brittle branches and is noted chiefly for its attractive flowers and nutritious fruit.

The smooth-margined, sharp-pointed, smooth, inverted egg-shaped, alternate leaves (Fig. 84 inset), 8–12 inches long and 4–6 inches wide, are light green above and paler beneath. The dark purple, perfect flowers are 1½ inches across and stand singly on stout, hairy stalks which are 1 inch or more in length. The greenish-yellow fruit is 3–5 inches long, 1½–2 inches wide and turns dark brown upon ripening. The large, hard seeds, up to 1 inch long, are embedded in the whitish to orange-colored, edible flesh. The smooth, dark brown, thin bark may become sparingly fissured on older trees. The wood is very coarse, light, spongy, and of no commercial value. Pawpaw is relatively free of diseases and insect pests. However, the larval stage of the zebra swallowtail (butterfly) feeds on pawpaw.

Persimmon

The persimmon (*Diospyros virginiana*) (Fig. 85), with its round-topped crown of spreading and somewhat drooping branches, frequently grows to a height of 25–30 feet and it may reach a height of 40–50 feet, with a branch spread of 30–40 feet. It prefers light, sandy, well-drained soil but also thrives in poor soil. It is native and widespread in the southern two-thirds of the state, and in southern Illinois it spreads rapidly in abandoned fields. Persimmon is suitable for ornamental plantings and has conspicuous, edible fruit and attractive orange to red foliage in autumn.

The firm, dark green, shiny, oblong, alternate leaves (Fig. 85 inset) are 4–6 inches long and 2–3 inches across. The male and female flowers are produced on separate trees and appear when the leaves are about half grown. The male flowers are produced in groups of two or three on hairy stalks. The creamy-white female flowers are produced singly at the ends of recurved stalks. The round, pulpy, yellow to orange fruit, up to 1½ inches in diameter, contains several flattened, hard, smooth

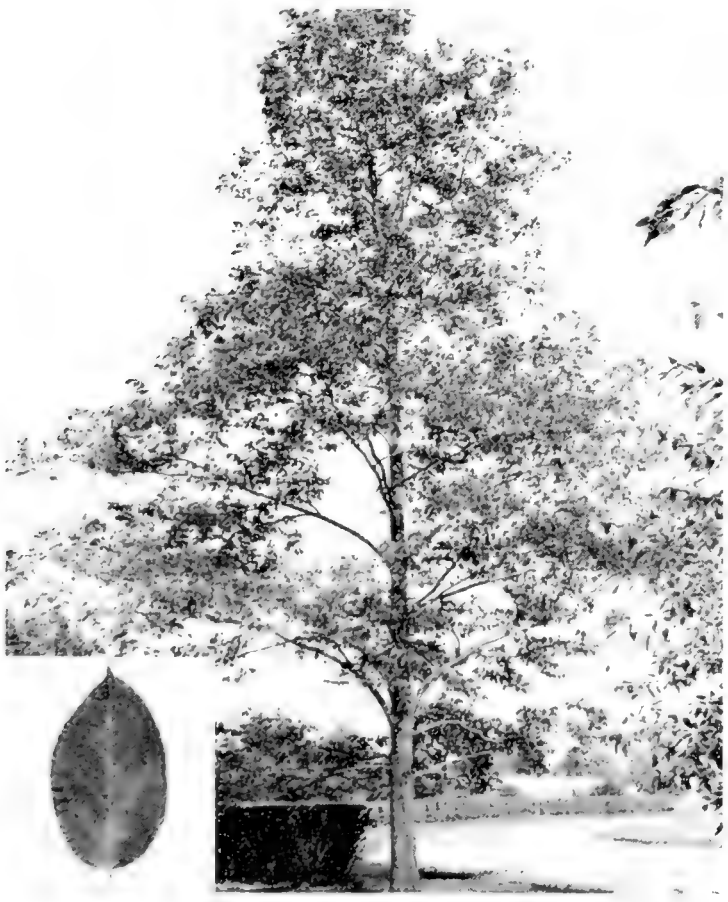

Fig. 85.—Persimmon is noted for its round, pulpy, edible fruit. Its leaves (inset) are oblong, leathery, and shiny.

seeds. The yellowish to light brown flesh of the fruit is very delicious and is used to make a rich and appetizing pudding.

The heavy, dense, hard wood of persimmon is used extensively in making wood articles which must withstand hard use. The heartwood is black and is sometimes called American ebony. Persimmon wilt, the only destructive disease of persimmon, has killed many trees in the southeastern states but has not been found in Illinois.

Pine

Pines are quite resistant to injury by ice and wind, and are used extensively in Illinois in windbreak and forest plantings as well as for specimen trees in ornamental plantings. They prefer an acid soil.

The male and female flowers are produced separately and as small cones on the same tree. The pollen is disseminated by wind.

The three pines native to Illinois are eastern white pine (*Pinus strobus*), jack pine (*P. banksiana*), and short-leaf pine (*P. echinata*). Introduced species that are planted extensively include red pine (*P. resinosa*), mountain pine (*P. mugo*), loblolly pine (*P. taeda*), pitch pine (*P. rigida*), Austrian pine (*P. nigra*), Scotch pine (*P. sylvestris*), and western yellow pine (*P. ponderosa*). Limber pine (*P. flexilis*) is used occasionally in ornamental plantings.

Eastern white pine (Fig. 86) is a tall, pyramidal, fast-growing tree which reaches a height of 100 feet or more. It grows on a wide variety of soils but makes the best growth on sandy loam soil. In dense stands it is devoid of branches a long distance upward. The trees shown on the front cover of this circular are in an area which originally had a dense stand. The trunk is straight, slightly tapered, and not divided to a height of 60 feet or more. The branches are produced in whorls like the spokes of a wheel, and usually there are five branches in each whorl.

The flexible, three-sided, blue-green needles (Fig. 86 insets) are 3–5 inches long, grow in bundles of five, and remain on the tree for two years. The very small, pollen-bearing cones are about ⅓ inch long, in clusters of 12–18, and are produced at the base of the current-season growth. The seed-bearing cones are produced on other twigs. They are solitary or in small groups of two to five and at first they are stalked, upright, cylindrical,

Fig. 86.—White pine is called a five-needle pine because its needles are produced in bundles of five (right inset) and each bundle is held together by a common sheath. Left inset shows numerous bundles of needles attached to the tip portion of a branch.

and about $^1_2$ inch long. By July of their second year these green cones are 4–6 inches or more in length and hang downward on long stalks. They turn brown and shed their seeds by autumn and drop to the ground during the following winter and spring. The dark gray bark of white pine is fairly thick on large trees and is divided into broad, continuous ridges by shallow, longitudinal, connecting fissures.

White pine is used extensively as a specimen tree in ornamental plantings. However, it is susceptible to the destructive white pine blister rust disease which has been found in some plantings in northern Illinois. Also, some insects such as sawfly, white pine weevil, pine needle scale, and pine bark aphid may attack white pines.

Jack pine, with its ragged outline, may grow to a height of only 15–40 feet and have a broad, open, stunted, irregular crown, or grow to a height of 60 feet and become picturesque with age. This tree thrives on poor, dry, sandy or rocky soil. The stout, stiff, $^3_4$- to 1¼-inch-long needles, sometimes curved and twisted, grow in bundles of two. The pollen-bearing cones are oblong and occur in clusters at the base of the new growth. The smaller seed-

bearing cones are globular to oval and are in clusters of two to four on the side of the shoot. With age they become yellow, oblong to conical, curved, and 1½–2 inches long. They cling to the tree for a decade or so and do not shed their winged seeds for several years. The dark brown bark on old trees is tinted red and is divided irregularly into narrow, rounded, scaly ridges. Jack pine is used only occasionally in ornamental plantings and mainly for its picturesque appearance. Also, it may be attacked by such insects as sawfly, white pine weevil, and Nantucket pine moth.

Short-leaf pine is a tall, straight, slender-trunked tree which may grow to a height of 80–100 feet. It thrives in well-drained, gravelly or sandy soils. The branches form a large oval to round crown. The dark, blue-green, slender, soft, flexible, finely-toothed needles are abruptly pointed, 3–5 inches long, and in bundles of two or three. The crowded clusters of yellowish-purple, pollen-bearing cones are about ¾ inch long. The pale rose, seed-bearing cones are produced on short, stout stalks in pairs or in groups of three or four, near the end of the current season's growth. The chestnut-brown, mature cones, 1½–3 inches long, remain attached to the branches for several years. The thick, cinnamon-red bark is broken into irregularly angular, scaly plates by a network of deep fissures. Short-leaf pine is a relatively slow-growing tree, is difficult to establish, and has only limited use in ornamental plantings.

Red or Norway pine (Fig. 87) is a tall, pyramidal tree, with stout branches which are sometimes pendulous, that grows to a height of 50–75 feet. It is adapted to various soil conditions and grows better than white pine on light, sandy loam soil. It thrives under low to medium rainfall. The soft, flexible, dark green needles (Fig. 87 insets) are 5–7 inches long, in bundles of two, and generally at the ends of the branches. The dense spikes of pollen-bearing cones are dark purple. The seed-bearing cones require two years to mature. They are small, scarlet, and upright during the first year, become pendant the second year, and are 1½–2¼ inches long when mature. Each scale bears two terminally winged seeds. The reddish-brown bark is broken into scaly plates by a network of shallow fissures. Red pine is used sparingly in ornamental plantings. However, it may be used for bold effects where few other pines grow. It is susceptible to Dothistroma needle blight, a fungus disease.

Mountain pine, sometimes called Swiss mountain pine, is usu-

Fig. 87.—Red pine has two long, flexible needles (right inset) in a bundle. Left inset shows numerous bundles of needles attached to the tip portion of a branch.

ally grown as a low, spreading shrub or as a pyramidal tree which may reach a height of 25 feet. The dwarf form is called mugo pine (Fig. 88). This is a hardy tree which thrives in stony and dry soil and is resistant to cold. The bright green, twisted, stout needles (Fig. 88 insets) are 1½–3 inches long and crowded two in a bundle. The small, pollen-bearing cones form in clusters at the base of the current season's growth. The mature, tawny-yellow to dark brown, oval-shaped, seed-bearing, cones are ¾–2½ inches long. The bark is gray and scaly. Mountain pine is relatively free of diseases but may be attacked by such insects as pine needle scale and European pine shoot moth.

Loblolly pine is a tall, straight-trunked tree that may grow to a height of 80–100 feet. It has a compact, round-topped crown composed of short, thick, spreading branches. The upper branches tend to droop downward. The dark green, slender, stiff, slightly twisted needles are 6–9 inches long and in bundles of three. The small, yellow, pollen-bearing cones are clustered at the base of young shoots. The yellow, seed-bearing cones are produced singly or in groups on short stalks. The mature cones are reddish brown, somewhat oval to oblong, and 2–5 inches

Fig. 88.—The shrublike mountain pine has two stout, twisted needles in a bundle (right inset). Left inset shows numerous bundles of needles attached to the tip portion of a branch.

long. The bright reddish-brown bark is irregularly divided into broad, flat ridges by a network of shallow fissures. The coarse-grained, weak, brittle wood is used for interior finishing and general construction purposes.

Pitch pine is a tall tree, with an open, irregular head of short, horizontal branches, that grows to a height of 50–75 feet. The rigid, spreading, dark green needles are 3–5 inches long and three in a bundle. The crowded spikes of pollen-bearing cones are yellow or rarely purple. The seed-bearing cones require two years to mature and develop as do those of red pine. They are oval shaped, 2–3½ inches long, often clustered on raised or short, stout stems, and persist for many years. Each scale has a sharp prickle and bears two terminally winged seeds. The reddish-brown bark is broken into broad, scaly ridges by deep fissures. Pitch pine will grow on dry, sandy or rocky soils too poor to support most other trees, and the old trees are frequently picturesque.

Austrian pine is a large, massive-appearing tree which grows to a height of 60–90 feet, and has numerous rough branches placed regularly around the trunk. The straight, slender, long, rigid, dark green needles are 3–7 inches long and two in a bundle. The pollen-bearing cones form at the base of current-season

shoots. The yellowish-brown, lustrous, seed-bearing cones are 2–3½ inches long when mature. The reddish-brown bark is deeply fissured into scaly plates. Although Austrian pine grows best in rich, light, loam soil with a well-drained subsoil, it also thrives in poor soil and will grow in sand fills. It is resistant to gas and smoke fumes in cities, to saltwater spray along seashores, and to drought conditions. For many years it was one of the favorite pines. However, in recent years it has been grown less extensively because it is frequently attacked by borers and by Dothistroma needle blight, a fungus disease.

Scotch pine grows fast and is pyramidal in shape when young. With age it becomes round topped and irregular in shape, with spreading, pendulous branches, and grows to a height of 50 feet or more. Some old trees are picturesque (Fig. 89). Some strains reach maturity in 25–30 years and then die, while other strains mature more slowly and live much longer. In recent years some strains of Scotch pine, especially those from Latvia, have been planted extensively for Christmas trees. The dull, grayish-yellow twigs and the yellowish to cinnamon-red bark are distinctive. The rigid, bluish-green, twisted needles (Fig. 89 insets) are 1¼–3 inches long and two in a bundle. The pollen-bearing cones are turned downward and are rough with short, hard points. The seed-bearing cones have short stalks, are symmetrical or occasionally oblique, and are turned downward. The cone scales are pointed backward. Scotch pine grows rapidly in acid or poor, sandy soil. It is relatively resistant to cold, drought, and drying winds. It may be attacked by several insects including sawfly, white pine weevil, pine bark aphid, European pine shoot moth, and Zimmerman pine moth.

Western yellow pine is a tall, hardy tree, with a narrow, pyramidal head and stout, spreading (sometimes pendulous) branches, that commonly grows to a height of 80 feet but may reach 150 feet or more. It grows best on moist but well-drained, deep soil and will thrive on pure clay as well as on sand or gravel. The orange-brown twigs are fragrant when broken. The bark is cinnamon-red to dark brown or nearly black and fissured into ridges which become large plates on old trees. The rigid, dark green needles are 5–11 inches long. Some trees have only two needles in a bundle while others have two needles in some bundles and three needles in others. The small, yellow, pollen-bearing cones are clustered at the base of young shoots. The oval-shaped, bright green to purple, fully grown, seed-bearing cones become

Fig. 89.—These tall Scotch pines are irregular in shape and devoid of branches a long distance upward. The tree to the right has a twisted trunk, common with age. The short needles are two in a bundle (right inset). Numerous needles on a shoot tip are shown in the left inset.

reddish brown and 3–6 inches long when mature. The tips of the thin cone scales are thickened and armed with slender prickles. Western yellow pine is used for screening and as background plantings in landscaping. It is an important timber tree in the West.

Limber pine (Fig. 90) is a narrow, pyramidal tree when young. It becomes broad and round topped with age and reaches a height of 45–75 feet. It thrives on a moist, well-drained, sandy loam soil, but it will tolerate poor soil. The branches are horizontal, pendulous, and extremely flexible. The dark green needles (Fig. 90 insets) occasionally have a bluish cast. They are 1–3 inches long, in bundles of five, and are shed in their fifth and sixth years. Each bundle of needles is twisted in a different direction. The branches are hairy at first but soon become smooth. Because of its tough, flexible characteristics, the tree is called limber pine. The small, reddish, pollen-bearing cones are clustered at the base of young shoots. The seed-bearing cones are green or rarely purple at maturity, somewhat cylindrical, 3–10 inches long, and about 1 inch broad. The dark brown seeds, $\frac{1}{2}$ inch or

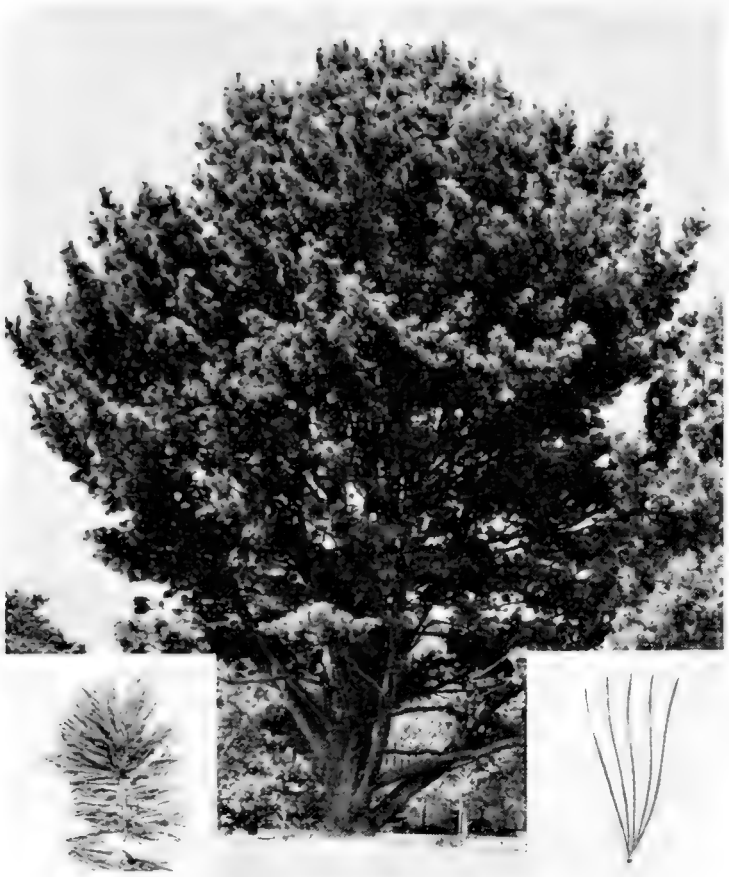

Fig. 90.—Limber pine becomes broad and round topped with age. The twisted needles (right inset) are in bundles of five. Numerous needles on a shoot tip are shown in the left inset.

less long, have thick shells. The bark, which is gray and smooth when young, becomes dark brown and deeply fissured with age.

Limber pine is used occasionally in ornamental plantings. It is relatively free of diseases and insect pests. The soft, light, close-grained wood is clear yellow but turns red when exposed to air. It is used occasionally for lumber.

Plum

Two plums, wild plum (*Prunus americana*) and wild goose plum (*P. hortulana*), are native to Illinois. These and several introduced species and selections are used in ornamental plantings because of their showy flowers and conspicuous fruits, or sometimes, as in the case of the purple-leaf plum, because of their foliage color.

Wild plum (Fig. 91), with its broad head formed from many spreading, upright branches, is common throughout the state. It grows on various types of soils and reaches a height of 20–30 feet, with a branch spread of 10 feet. The long-pointed, egg-shaped, firm, alternate leaves (Fig. 91 inset), 2½–4 inches long and 1½ inches wide, have sharply toothed margins and are dark

green above and paler beneath. They are smooth when young but become wrinkled with age. In early spring, the conspicuous, white, perfect flowers appear before the leaves. They are produced in small clusters and the petals are bright red at the base. The 1-inch diameter, round fruit turns bright red upon ripening and contains a flattened, rough, oval pit. The fruit makes excellent jellies and preserves. The red-tinted, brown bark is divided by fissures into plates. Although the close-grained wood is heavy, hard, and strong, it has no commercial value.

The wild goose plum, with its broad crown of rigid, spreading branches, grows to a height of 25–30 feet. It is common in most of southern and western Illinois. The shiny, thin, dark green, alternate leaves are smooth above and slightly hairy beneath. They are 4–6 inches long and 1 inch or more wide, and have finely toothed margins. The small clusters of perfect flowers, with white petals that frequently are orange tinted at the base, appear mostly before the leaves. The round to slightly oval, hard-fleshed fruits, $^{3}/_{4}$–1 inch in diameter, are covered with a thick, tough, red or yellow skin and contain rough, pitted stones. The dark brown bark is thinly plated. Many horticultural

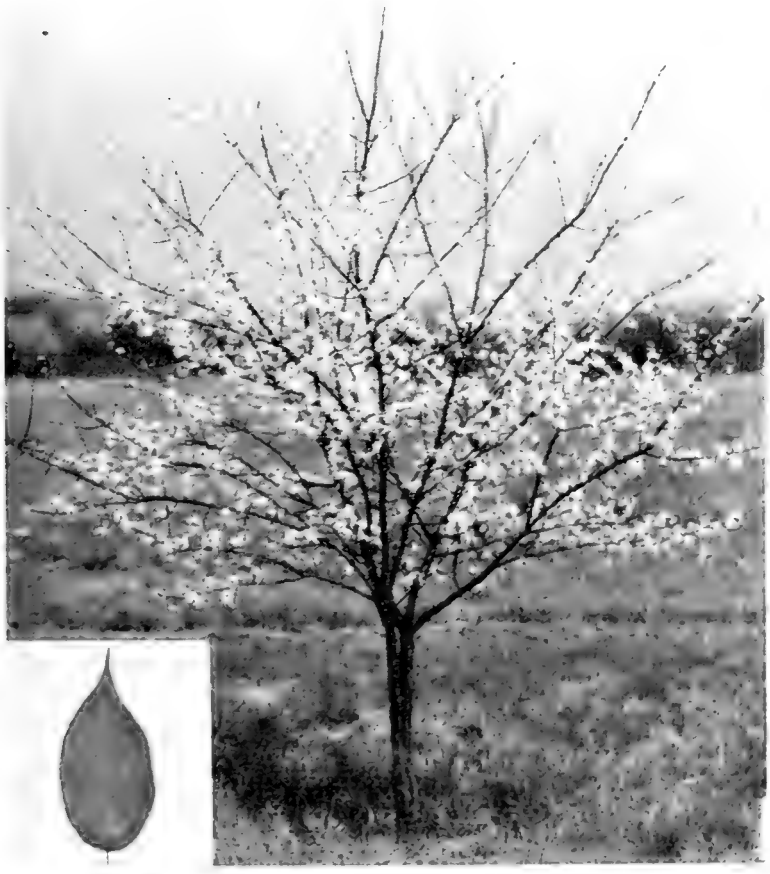

Fig. 91. — Wild plum produces small clusters of white flowers before the leaves appear in the spring and round fruit that ripens in the autumn. The long-pointed leaves (inset) have sharp-toothed margins.

varieties have been developed from the wild goose plum. The heavy, hard, strong, close-grained wood is suitable for turnery.

Poplar

Most poplars (including cottonwoods and aspens) are large, fast-growing trees that live a relatively short time. They have simple, triangular to circular, usually toothed, alternately arranged leaves (Fig. 92 and 93 insets) on round or five-sided, moderate-sized twigs. The leaves of quaking aspen and most other poplars have flattened petioles (leaf stems) which allow the leaves to quiver in the slightest breeze. The male and female flowers are produced in catkins on separate trees before the leaves appear. The fruit is a small capsule borne in necklace-like strings which contain many small seeds in a cottony mass.

Poplars native to Illinois are: quaking aspen (*Populus tremuloides*), large-toothed aspen (*P. grandidentata*), swamp cottonwood (*P. heterophylla*), and cottonwood (*P. deltoides*) (Fig. 92). Other poplars planted in Illinois and used to some extent in landscaping and in ornamental plantings are: bolleana

Fig. 92.—The fast-growing cottonwood has limited use for park or specimen planting. Each triangular-shaped leaf (inset) is attached to the twig by a flattened stem.

(*P. alba* var. *pyramidalis*), Carolina (*P.* x *canadensis* var. *eugenei*), Lombardy (*P. nigra* var. *italica*), and white poplar (*P. alba*). Lombardy (Fig. 93) and bolleana poplars are upright forms, with ascending branches, that may grow to a height of 100 feet. They are used to some extent as specimen trees, as border plantings to serve as a screen, or in other situations where rapid growth is desired. Most other species of poplar have narrow to broad, open, round-topped crowns. White and Carolina poplar, aspen, and cottonwood are used in parks and for specimen trees. While most of these poplars will grow on a variety of sites, swamp cottonwood prefers swampy ground.

Poplars are frequently attacked by borers and canker diseases and should be used sparingly in ornamental plantings. Lombardy poplars are frequently killed by borers or Cytospora canker by the time they are 10–15 years old (Fig. 9). The wood of poplars is light, close grained, soft, and weak, and is of less commercial value than the wood of many other trees. It is used for pulp, baskets, boxes, crates, excelsior, and to some extent for lumber.

Fig. 93.—Lombardy poplar is a tall, slender, fast-growing tree used for screening and accent purposes. The leaves (inset) are broader than long.

Redbud

Redbud or Judas tree (*Cercis canadensis*) is a small, slow-growing tree (Fig. 94) that may occasionally grow to a height of 35 feet and have a branch spread of 20–30 feet. The trunk seldom measures over 1 foot in diameter. Redbud is native to Illinois except in the northeastern part of the state. It thrives best in moist, rich soil and in partial shade and may be injured by hot, dry weather. It has stout branches which usually form a wide crown. Redbud is conspicuous in early spring because of the brilliant rosy-red, pea-like, perfect flowers which form in clusters on the twigs and small branches. Flowers appear before or at the time the leaves are unfolding. Because of this flowering habit redbud is used extensively in ornamental plantings.

The glossy green leaves (Fig. 94 inset) are alternate, nearly circular to heart-shaped, and 3–5 inches in diameter. Margins are entire and each stem has a bulbous swelling at each end. The leaves turn bright yellow in autumn. The fruit, which contains many seeds, develops as a thin, oblong, flat pod that is 2–4 inches long and has tapered ends. It is reddish during the summer, becoming brown in the fall, and may remain attached to the

Fig. 94. — The small, slow-growing redbud is prized for its brilliant rosy-red, pea-like flowers, which appear in early spring before or at the time the heart-shaped leaves (inset) unfold.

branches for most of the winter. The bark is red-brown, scaly, and deeply fissured.

Redbud is resistant to injury by ice and wind. It is subject to two fungus diseases, Verticillium wilt and Botryosphaeria canker, each of which may result in the death of affected trees. Occasionally the foliage is damaged by the two-spotted spider mite, which can be controlled by spraying with a miticide. The rich, dark brown, close-grained wood is weak and has very little commercial value.

Russian Olive

Russian olive or oleaster (*Elaeagnus angustifolia*), native of central and western Asia and southern Europe, is a low-growing, somewhat shrublike tree (Fig. 95) that is hardy throughout Illinois. It develops a crooked trunk with an irregular crown of silvery twigs, and is sometimes spiny. It reaches a height of 20 feet, with a branch spread of 20–40 feet. Russian olive is used in background or group plantings where silvery-white foliage and gray twigs are desired.

The 1½- to 3-inch-long, lance-shaped, blunt-tipped leaves

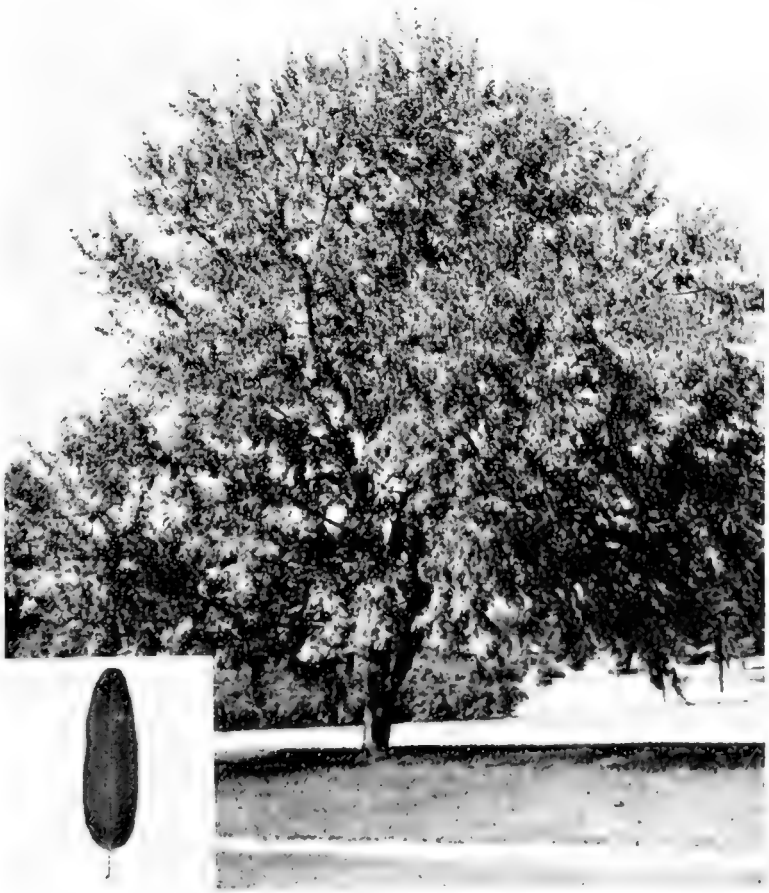

Fig. 95.—Russian olive has distinctive foliage. The blunt-tipped, lance-shaped leaves (inset) are whitish green above and silvery beneath.

(Fig. 95 inset), with smooth margins, are whitish-green above and silvery beneath. The small, fragrant, inconspicuous, perfect flowers, silvery on the outside and pale yellow within, appear in June. The ½-inch-long, sweet, mealy, oval, one-seeded, yellow fruit, covered with silvery scales, ripens in August. Although the smooth branches are brown, the twigs are covered with gray, star-shaped hairs. The dark gray trunk bark is furrowed, and it becomes scaly with age. Russian olive is relatively free of insect pests and resistant to injury by ice and wind. An occasional tree is affected by Verticillium wilt.

Sassafras

Sassafras (*Sassafras albidum*) (Fig. 96), with its stout, almost horizontal branches, may grow as a small, flat-topped tree in poor soil, reaching a height of only 40–60 feet. However, on rich soil it may reach a height of 80–90 feet. Branch spread varies from 25 to 40 feet. It is common in abandoned fields and along fence rows, preferring a rich, sandy, well-drained soil. It grows throughout the southern two-thirds of the state. It is useful in ornamental plantings, especially around low, one-story

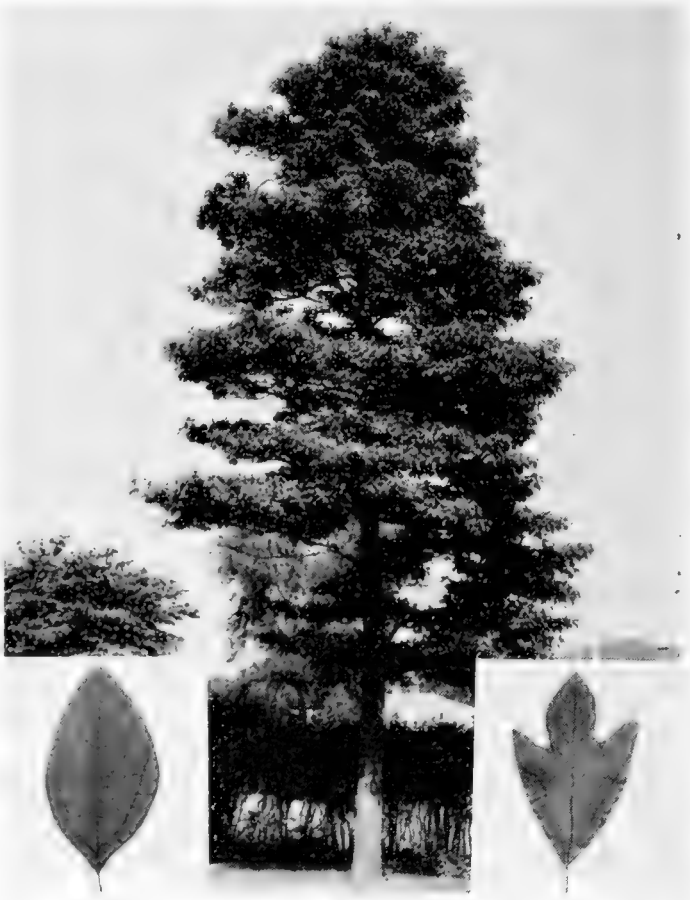

Fig. 96.—Sassafras has aromatic leaves which vary from those with no lobes (left inset) to those with three lobes (right inset). Some leaves resemble mittens.

buildings and in borders or backgrounds. Sassafras tea, a delicious drink, is made from the roots.

The rather firm, alternate, dark green, egg-shaped, aromatic leaves, 4–6 inches long and 2–4 inches wide, (Fig. 96 insets), vary from entire to three-lobed and some resemble a mitten. They turn orange-scarlet in autumn. The attractive yellow clusters of male and female flowers are formed in the spring on separate trees. The dark blue, lustrous fruit is usually ¼–½ inch long. It is a one-seeded berry in a small, orange-red or scarlet cup which stands on a scarlet stem that is 1½–2 inches long. The young twigs are hairy, bright green, and aromatic. The dark cinnamon-brown bark is deeply furrowed with horizontal cracks. Although the wood is fairly soft and light, it is durable and is used for fence posts, rails, and railroad ties.

Serviceberry

Serviceberry, shadbush, shadblow, or juneberry (*Amelanchier arborea*) (Fig. 97), a small native tree with spreading branches, grows to a height of 30 feet and on occasion may reach 50 feet. It prefers partial shade and grows more commonly on

Fig. 97.—The small, shrublike serviceberry tree produces showy white flowers in early spring before the leaves (inset) unfold. These two young trees are in a border planting.

rocky slopes or cliff tops. It is useful in decorative plantings but is somewhat difficult to grow.

The sharply pointed, slender-stalked, alternate leaves (Fig. 97 inset), 2–4 inches long by 1–2 inches wide, are yellowish green above and paler and somewhat hairy beneath. They have sharply toothed margins. The showy, white, perfect flowers, which appear before the leaves in early spring as erect or drooping clusters, resemble the flowers of cherry. The fruit is a round, purple, dry, insipid berry ¼–⅓ inch in diameter. The thin trunk bark is conspicuous because of its light gray color and scalelike ridges. Serviceberry is seldom seriously damaged by diseases, but it is an alternate host of some of the rusts which affect junipers. The heavy, hard wood is of little commercial value although it has been used in making tool handles, bows, fishing rods, and lances.

Spruce

Although it is not native to the state, spruce is one of the most common evergreens used in ornamental and windbreak plantings in Illinois. It is also grown extensively for Christmas trees. Norway spruce (*Picea abies*), white spruce (*P. glauca*), and Colorado blue spruce (*P. pungens*) are excellent for windbreak plantings.

Engelmann (*P. engelmanni*), blackhill (*P. glauca densata*), Koster blue (*P. pungens* var. *Kosteriana*), Colorado blue (Fig. 98), Norway, and white spruces are used extensively in ornamental plantings. Spruces are pyramidal in shape and have scaly bark and branches in whorls. They grow best in deep, moist, sandy loam soil, and often reach a height of 50–70 feet.

The needles (Fig. 98 inset), usually four sided and spirally arranged, persist for several years. They vary from ⅓ to 1 inch long and from bluish green to dark green on the above species. They sit on cushion-like growths which make the deeply grooved twigs appear corrugated. Male and female flowers are borne separately on the same tree. The yellow to red catkin-like male flowers are produced in axils. The green to purple female flowers are produced terminally and develop into oval to cylindrical cones which are pendulous. Two small, compressed, winged seeds are produced under each persistent scale.

Spruce trees in ornamental plantings are frequently infested with spruce spider mites which feed on the needles, causing many needles to drop during the growing season. Spruces are suscep-

Fig. 98.—Colorado blue spruce is prized for the bright blue-green color of its needles. Inset shows numerous needles on the tip portion of a branch.

tible to a fungus disease called Cytospora canker, which may result in the killing of lower branches and occasionally of entire trees. Norway and Colorado blue spruce are more resistant than other spruces to injury by ice and wind. The soft, light, fine-grained wood of spruce is used extensively for lumber and pulp. Wood of red and white spruce is excellent for sounding boards of musical instruments because of its resonant qualities.

Sweet Gum

Sweet gum or red gum (*Liquidambar styraciflua*), which prefers an acid soil, is a tall-growing tree that reaches a height of 70–100 feet on the bottomlands that are not inundated in southern Illinois. Occasionally it is found growing in moist soil on hillsides. It is an excellent lawn tree (Fig. 99) that is well adapted to the southern and central parts of the state.

Sweet gum produces conspicuous, five- to seven-pointed, star-shaped, aromatic, alternate leaves (Fig. 99 inset), 4–7 inches across, and dark green above and pale green beneath. They become brilliant yellow, orange, red, and purple in autumn. Male and female flowers are borne separately on the same tree.

Fig. 99.—The slow-growing sweet gum is conspicuous because of its distinctive five- to seven-pointed, star-shaped leaves (inset). These aromatic leaves become brilliant yellow, orange, red, and purple in autumn.

The hairy clusters of male flowers are 2–3 inches long. The clusters of female flowers are produced in swinging, globe-shaped heads. The hard, ball-like fruits, 1–1½ inches in diameter, may be objectionable in lawns. They contain ½-inch-long, brown, resinous, winged seeds which are set free in autumn. The gray trunk bark may show flaky ridges.

Sweet gum is resistant to injury by ice and wind and it is relatively free of diseases and insect pests in Illinois. However, two diseases that kill sweet gum trees have been reported, one in Alabama and one in Maryland. The heavy, hard, close-grained wood of sweet gum is not very strong. However, it is used extensively in interior finishing because of the alternating streaks of red and black and the fine texture of the wood. It is also used as a substitute for walnut and mahogany in the manufacture of furniture.

Sycamore

Sycamore (*Platanus occidentalis*), also called buttonball and buttonwood (Fig. 100), is native to Illinois. Although it prefers moist, fertile bottomland, occasionally it is found growing on

Fig. 100.—The fast-growing American sycamore has been planted extensively in recent years where elms have died. Its maple-like leaves (inset) are broad and firm.

dry ridges or rock ledges, and it is grown extensively in dry, upland soils. Sycamore and two introduced species, London plane tree (*P. acerifolia*) (Fig. 101) and oriental plane tree (*P. orientalis*), are used in shade, street, and ornamental plantings. They are tolerant of drought as well as smoke and other adverse city conditions. They grow rapidly, reaching heights of 70–100 feet, with horizontal branches that have a spread of 50–75 feet.

The large, thin, firm, broad-bladed, coarsely toothed, alternate leaves (Fig. 100 and 101 insets) are 4–7 inches across, bright green on top and pale beneath, with fine, conspicuous hairs where the veins are attached to the midrib. Leaves of sycamore and London plane tree have three to five sharp-toothed lobes, and those of oriental plane tree have five to seven lobes. The stout leaf stems are 3–5 inches long. The enlarged, hollow base of each leaf stem encloses next year's bud. Male and female flowers are borne separately on the same tree. Although both types of flowers are inconspicuous, the fruits are globose, brownish, prickly balls about 1 inch in diameter which hang from the branches by long, slender, flexible stems 3–5 inches long. Usually there are two balls per stem on London plane tree, two to

Fig. 101.—London plane tree, with its large maple-like leaves (inset), is difficult to distinguish from the American sycamore. However, the bark of London plane tree is usually more greenish in color.

four balls per stem on oriental plane tree, and one ball per stem on sycamore. These balls, conspicuous on the trees during the winter months, break apart in early spring, releasing the small seeds which are scattered by the wind. The trunk bark is conspicuous because of its habit of peeling off in large patches annually. It is greenish white to creamy white on sycamore and dull grayish to greenish white on London and oriental plane trees. The bark on large branches and the trunks of young trees is very smooth and greenish gray. The thick, dark brown bark on the trunk bases of old trees is divided by deep furrows.

The hard, heavy wood of sycamore, with its abundant cross grains, is difficult to split and tends to twist and warp during seasoning. It is used extensively for furniture, interior finishing, veneer, tool handles, butcher's blocks, and boxes.

Sycamore is susceptible to a fungus disease called leaf blight or anthracnose. During cool springs this disease may cause abundant killing and defoliation of young leaves, similar to the injury resulting from severe frosts. Twigs and branches may also be killed by the anthracnose fungus. This disease can be

effectively controlled by applying an organic mercury fungicide at the time the buds are swelling.

Thousands of London plane trees in the Atlantic Coast region from Philadelphia to Washington, D. C. have been killed by a fungus disease called canker stain. This disease occurs principally in the eastern and southern parts of the United States. Although it was reported affecting dozens of trees in St. Louis in 1947, it has not been found in Illinois. The fungus produces cankers on branches and trunks, and seriously affected trees are killed. To control this disease, special care is required in treating or removing diseased trees and in protecting healthy trees. Information on the procedures to follow should be obtained from a plant pathologist. This disease also has been reported on sycamore, which appears to be much less susceptible than London plane tree.

Many London plane trees in Illinois show extensive trunk splitting (Fig. 10) when temperatures are quite low during the winter months. These splits or cracks are referred to as frost cracks. They may measure up to several inches across and several feet long, and they may penetrate the trunks only a few inches or to the center of the heartwood. Usually these cracks close in the spring and callus forms over them during the growing season. Callused-over, shallow cracks may not open in succeeding winters. However, deep cracks usually reopen winter after winter.

Tree of Heaven

Tree of heaven, (*Ailanthus altissima*) (Fig. 102), introduced from China, grows rapidly and may reach a height of 50–60 feet. It is recommended for planting in industrial and other areas where other trees do not thrive. However, it is not desirable for lawn, park, and parkway plantings because it spreads rapidly by root suckers and by seed.

The alternate, large, plumelike, compound leaves (Fig. 102 inset) measure 1–3 feet long and are composed of 11–41 short-stalked, broadly lance-shaped, 3- to 5-inch-long leaflets that are bright green above and paler below. Each leaflet has two to four coarse teeth at its base. The yellowish-green, ¼-inch-long flowers, produced in June, form upright clusters a foot or more in length. The male flowers give off a disagreeable odor. They may be borne on the same trees that bear female flowers, or on separate trees. Large clusters of brilliantly colored, winged

Fig. 102.—The rapid-growing tree of heaven produces sparse shade and frequently produces root suckers that are troublesome in lawns. Each large, plumelike leaf (inset) is composed of 11-41 leaflets.

seeds, 1½ inches long, are conspicuous in late summer and fall. The smooth to rough gray bark has pale stripes formed by shallow fissures.

This tree is relatively free of insect pests. An occasional tree is affected by Verticillium wilt, and the foliage of some trees may show scorch during late July and August. Although the wood is soft, weak, and coarse grained, the tree is seldom damaged by wind and ice. Since the wood is not durable, it is not used commercially.

Tulip Tree

Tulip tree (*Liriodendron tulipifera*) (Fig. 103) is frequently called yellow poplar and is sometimes referred to as saddle tree, canoewood, whitewood, or blue poplar. It is recommended for ornamental and shade purposes throughout Illinois, although its natural range extends northward only to St. Clair County in the west and to Vermilion County in the east. It grows rapidly and thrives on moist, well-drained soils. Tulip tree normally reaches a height of 80–100 feet (occasionally 150 feet) and has a branch

Fig. 103.—The fast-growing tulip tree is sometimes called saddle tree because of the saddle shape of its four-lobed leaves (inset).

spread of 50–70 feet. In the forest the straight, thick trunk may be free of branches to a height of 50 feet or more.

The smooth, shiny, saddle-shaped, alternate leaves (Fig. 103 inset) are dark yellow-green above and pale beneath. It is natural for many tulip trees to have scattered leaves turn bright yellow in late July and August. The leaves have four distinct, pointed lobes and measure 3–6 inches in both length and breadth. The perfect flowers, which appear in May or June, are greenish white with an orange band at the base, tulip shaped, and 1½–2 inches long. The cone-shaped, brown fruit ripens in September and October. It is 2½–3 inches long and contains winged seeds with a hard, bony coat. The brown bark is thin and scaly when young but becomes deeply furrowed with age. On young branches the bark is dark green and smooth at first but it soon shows scattered white spots in the developing fissures.

Although the light, soft, brittle wood is weak, it is receptive to paint and glue and is used for exterior trim, interior finishing, furniture, veneer, shingles, boats, drawing boards, tables, cabinets, toys, and novelties. Tulip tree is resistant to injury by ice

and wind, but in recent years it has shown considerable susceptibility to Verticillium wilt. Most of the affected trees observed have died.

Tupelo

Two species of tupelo, tupelo gum (*Nyssa aquatica*) and tupelo (*N. sylvatica*) are native in Illinois. Tupelo, also called sour gum and black gum, produces a long, narrow crown of numerous slender, horizontal to somewhat drooping branches. It reaches a height of 70–90 feet, with a branch spread of 30–50 feet. When growing in the open it frequently does not grow so tall, and forms a round or cylindrical head (Fig. 104). It grows as a native tree in the southern third of Illinois along streams and in low, wet places. Colonies of tupelo occur in the sandy areas of Kankakee and Cook counties. It is excellent for ornamental plantings, except in the extreme northern part of the state where it may be damaged by winter injury.

The thick, firm, shiny, smooth-margined, elliptic, alternate leaves (Fig. 104 inset) are dark green above, gray and somewhat hairy beneath, and 2–5 inches long by 1–3 inches wide.

Fig. 104.—Tupelo or sour gum is conspicuous in autumn because of its brilliant red foliage. The leaves (inset) are 2–5 inches long.

These leaves, clustered toward the ends of the twigs, turn brilliant red in the autumn. The green male and female flowers usually are produced on separate trees, although some trees bear perfect flowers. Male flowers are produced in many-flowered heads. Female flowers are produced in two- to several-flowered clusters. The dark blue, globe- to egg-shaped fruit, $\frac{1}{2}$–$\frac{3}{4}$ inch long, is produced singly or in clusters of two or three on long, slender stems. The single, hard-shelled, light brown seed in each fruit is slightly flattened and has 10–12 longitudinal ridges. The deeply and narrowly fissured, red-tinged, brown bark is formed with a pattern of oblong blocks resembling that of alligator skin.

Tupelo is resistant to injury by ice and wind and is relatively free of diseases and insect pests. However, in recent years numerous branches of a few trees have been killed by Botryosphaeria canker, and a few trees have been killed by Verticillium wilt. The strong, tough, heavy wood of tupelo is neither hard nor durable, and it tends to warp and twist in seasoning. However, the tough, twisted grain makes it useful for veneer, mallets, rollers, wheel hubs, gun stocks, and rough flooring.

Tupelo gum or cotton gum, with its narrow, oblong crown of small, spreading branches, reaches a height of 80–100 feet. In Illinois it is confined to the cypress swamps in eight counties in the southern tip of the state and Crawford, Richland, and Wabash counties. The shiny, firm, alternate leaves, 5–7 inches long and 2–4 inches wide, are dark green above, paler and hairy beneath, and may have slightly toothed margins. Male and female flowers are produced separately on the same tree, the male flowers being in dense clusters and the larger, greenish, female flowers solitary. The conspicuously dotted, dark purple, datelike fruit, about 1 inch long, has a thick, tough skin and contains a flattened seed with ten sharp, winglike ridges. The dark brown, scale-roughened bark is conspicuously furrowed. The brown to nearly white wood is soft, light, weak and difficult to season. However, it is more easily worked than that of tupelo. It is used for boxes, crates, flooring, and interior finishing.

Walnut

Black walnut (*Juglans nigra*) and butternut or white walnut (*J. cinerea*) are native woodland trees which grow in rich bottomlands and on moist, fertile hillsides throughout the state. They are slow-growing trees which produce sparse shade and are used only sparingly in ornamental plantings.

Black walnut (Fig. 105) usually grows tall and straight in woodland areas, reaching a height of 70–90 feet and having a branch spread of 50–70 feet. An occasional tree may reach a height of 150 feet. The trunk may be clean of branches to a height of 40–50 feet. However, in open areas or as specimen trees, black walnut usually produces a short trunk with a broad-spreading crown. The twigs are hairy at first but later become smooth and orange to dark brown.

Black walnut is one of the last trees to leaf out in the spring and one of the first to lose its leaves in the fall. The large compound leaves (Fig. 105 inset), 1–2½ feet long, are made up of 5–11 pairs of oblong to lance-shaped, short-stalked, leaflets, and usually there is one long-stalked leaflet at the tip. Sometimes the terminal or tip leaflet fails to develop, leaving an even number of leaflets. The irregularly toothed leaflets are 2½–5 inches long and each leaflet has a pointed tip and a rounded base. Male and female flowers are borne separately on the same tree, the male flowers in pendulous catkins and the female flowers in small, inconspicuous clusters. The large- globe-shaped, rough, fleshy-

Fig. 105.—The slow-growing black walnut is used occasionally as a specimen tree or for its highly prized nuts. The large, compound leaves (inset) are made up of 5–11 pairs of leaflets and usually have a single terminal leaflet.

covered, hard-shelled fruit (commonly called "nut") measures 1½–2 inches in diameter and is prized highly for its sweet, oily, nutritious seed. The deeply furrowed bark is brown.

Butternut usually grows to a height of 30–50 feet but may reach 100 feet. Its trunk is usually short and the round-topped crown is open and scraggly. The stout, lustrous twigs are greenish at first but become reddish- or orange-brown with age. The gray bark is deeply furrowed. The compound leaves are 15–30 inches long and made up of three to nine pairs of short-stalked leaflets and one long-stalked leaflet at the end. The leaflets are 3–4 inches long and 1½–2 inches wide. Male and female flowers are borne separately on the same branchlet and usually near each other. The male flowers are in pendulous, cylindrical catkins, 2–3 inches long, that grow from lateral buds on year-old twigs, and the ⅓-inch-long female flowers are in spikes of six to eight flowers at the tip of new twig growth. The large, elliptical-shaped, four-ridged, roughly corrugated, pointed fruit (commonly called "nut") is 1½–2½ inches long and contains a sweet, edible seed.

In some years, premature defoliation of black walnut is caused by a fungus disease called leaf blight or anthracnose. However, greater injury from defoliation is caused more frequently by the walnut caterpillar. Some trees may be attacked annually by this insect. The heavy, hard, coarse-grained, rich brown wood of black walnut is used extensively in the manufacture of furniture, gun stocks, and veneer. The light, coarse-grained wood of butternut has only limited commercial value. It is used to some extent for the interior finishing of houses and the lining of furniture drawers and cabinets.

Willow

Black willow (*Salix nigra*) and peach or almond willow (*S. amygdaloides*), both native to Illinois, have only limited use in ornamental plantings. Several introduced willows—including Babylon weeping (*S. babylonica*) (Fig. 106), bay or laurel-leaved (*S. pentandra*), white (*S. alba*), Wisconsin weeping (*S. blanda*), and yellowstem white (*S. alba* var. *vitellina*) willow—are used for landscape purposes. The willows are fast-growing trees which reach heights of 30–50 feet, with a branch spread of 15–50 feet. They prefer moist, rich soil and frequently are planted near water. However, they will thrive in dryer sites.

The leaves (Fig. 106 inset) of most willows are long and

Fig. 106.—The fast-growing weeping willow, with its long, lance-shaped leaves (inset) is prized for its weeping or pendulous branches.

lance shaped, up to 6 inches long, and have finely toothed margins. They vary from dark to light green and shiny above and from pale green to shiny or silvery below. The undersides of leaves of the yellowstem white willow are smooth to slightly hairy with a whitish bloom that gives a silky appearance. The conspicuous male and female flowers, produced on erect catkins, are borne on separate trees. The fruits are small capsules which split at maturity to discharge the silky-haired seeds which are carried long distances by wind. Willows are conspicuous in the spring because they are among the first trees to unfold leaves and the bark on twigs is yellowish green. The brown to nearly black bark on trunks of old trees is divided by deep furrows into broad, flat, connected ridges.

Willows growing under adverse conditions, and old trees may be attacked by borers and by Cytospora canker, a fungus disease. These troubles frequently result in death of affected trees. Although the wood of willow is fine grained, soft, and light, it is quite tough and is used for crates, baskets, boxes, charcoal, coarse lumber, and pulp.

Yellowwood

Yellowwood (*Cladrastis lutea*) (Fig. 107) with its broad, round, graceful crown, reaches a height of 50–60 feet and has a branch spread of 40–50 feet. It prefers rich, well-drained soil, especially the limestone ridges along stream banks. It is used as a specimen tree in ornamental plantings but is somewhat difficult to transplant.

The alternate, compound leaves (Fig. 107 inset) are 8–12 inches long and composed of 7–11 elliptical to egg-shaped, smooth, bright green leaflets that are 2¾–4 inches long. The foliage turns bright yellow in autumn. The beautiful, white, fragrant, 1-inch-long, conspicuous, perfect flowers are produced in 10- to 16-inch-long, drooping clusters. The fruit is 2¾–3¼ inches long. It is a narrow, flattened, leguminous pod that splits open at maturity. Each pod contains three to six oblong, compressed seeds. The thin, smooth, steel gray, beechlike bark becomes fissured with age. The wood is light, hard, and strong. The freshly cut, clean, yellow heartwood soon turns brown. Yellowwood is relatively free of diseases and insect pests. However, an occasional tree is affected by Verticillium wilt.

Fig. 107.—Yellowwood is a medium-sized tree noted for its conspicuous clusters of beautiful and fragrant flowers. Its compound leaves (inset) are composed of 7–11 elliptical or egg-shaped leaflets.

Zelkova

Zelkova or Japanese keaki tree (*Zelkova serrata*) (Fig. 108), introduced into the United States from Japan about 1860, is a short-trunked and usually crooked-trunked tree with many upright stems which form a broad, round-topped head. It grows to a height of 50–60 feet, with a branch spread of 20–35 feet. It is used as a specimen tree in ornamental plantings and is hardy in the southern two-thirds of Illinois.

The sharply and coarsely toothed, oval to oblong leaves (Fig. 108 inset) are 1–4 inches long. The foliage turns light yellow in autumn. Short-stalked male, female, and perfect flowers are produced on the same tree. Male flowers are produced as clusters in the axils of the lower leaves. Female and perfect flowers are produced singly or in groups of a few in the axils of the upper leaves. The one-seeded, fleshy fruit ripens in autumn. The smooth, reddish-brown bark forms rows of small scales. The tough, elastic wood is used in jinrikishas in Japan. It has no commercial value in this country where the tree is used only for ornamental purposes. Although Zelkova has been found susceptible to Dutch elm disease when inoculated with the fungus, it is relatively free of diseases and insect pests in the United States.

Fig. 108.—Zelkova, used as a specimen tree in ornamental plantings, has coarsely toothed leaves (inset) that turn light yellow in autumn.

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The photographic illustration for figure 91 was furnished through the courtesy of the Morton Arboretum, Lisle, Illinois.

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